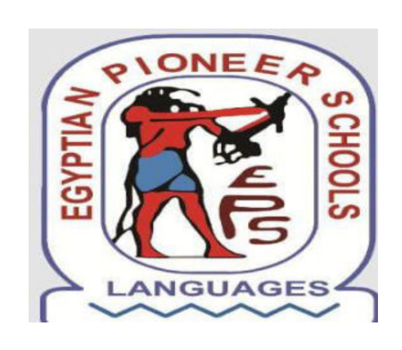


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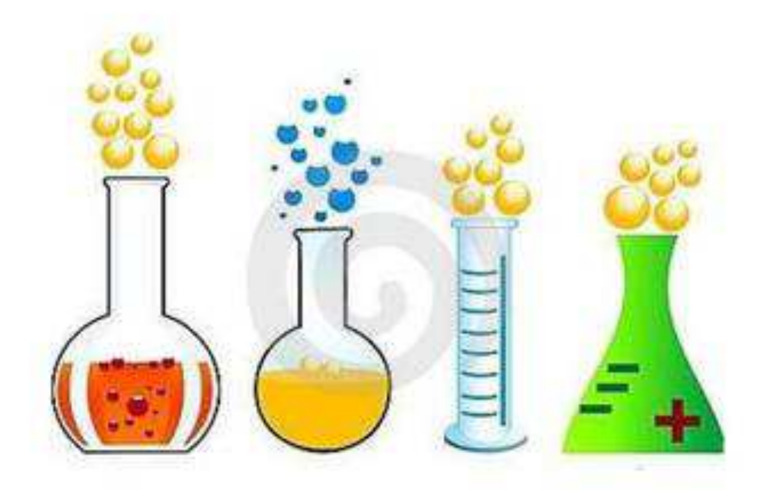
Preparatory 3
Science – Booklet
Second Term

Name: ____________________

Class ______

Prepared by: Asmaa Kassem

Unit 1: Chemical Reactions



Lesson 1: Chemical Reactions

Lesson 2: Speed of Chemical reactions



1

Lesson 1

Chemical Reactions

Revision

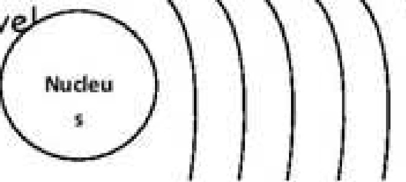
1. **The atom** is the smallest unit of an element which undergoes a chemical reaction without being changed.
2. The atom consists of :
   a. The nucleus contains positively charged **protons** & neutral particles called **neutrons**.
   b. **Electrons** are negatively charged particles which revolve around the nucleus in energy levels with high speed.
3. The **atomic number** is the number of protons in the nucleus .
4. The **mass number** is the number of protons + neutrons in the atom.
5. The number of protons = the number of electrons in a neutral atom.

Energy levels

1. Electrons revolve around the nucleus in fixed orbits called energy levels.

2. The smallest atom (hydrogen) has one energy level

3.The biggest atom has 7 energy levels.



K L M N O P Q

The electronic configuration

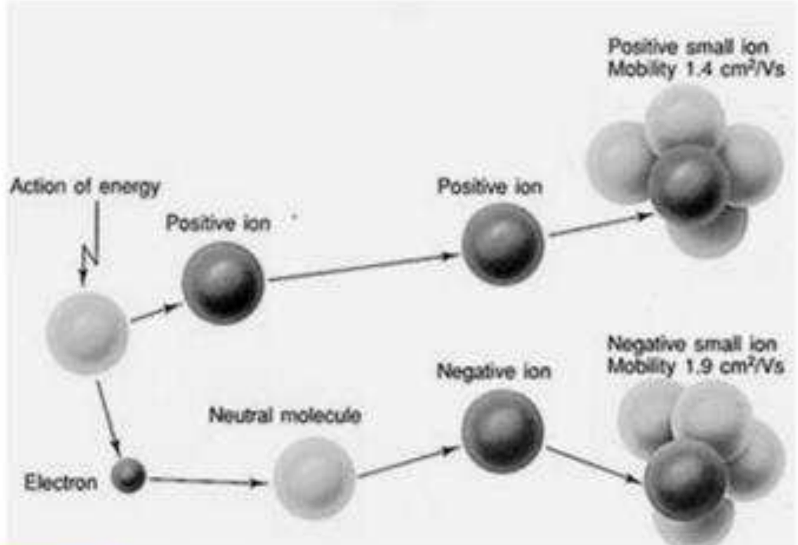
Each energy level is saturated with a certain number of electrons.

1. The rule $2n^2$ is used to find the number of electrons that fill each energy level. n is the number of the level.
2. The first energy level is filled with : $2(1)^2 = 2$ electrons.
3. The 2nd energy level is filled with : $2(2)^2 = 8$ electrons.
4. The 3rd energy level is filled with $2(3)^2 = 18$ electrons.
5. The 4th energy level is filled with $2(3)^2 = 32$ electrons.

6. Levels 5-7 are filled with 32 electrons only . The rule $2n^2$ isn't applied because the level can only contain 32 electrons. The presence of more than 32 electrons in an energy level would make the atom unstable.

Valency is the number of electrons gained or lost or shared by an atom in a chemical reaction .

Element	Valency		Ion
Sodium	1	mono	Na^{1+}
calcium	2	di	Ca^{2+}
Aluminium	3	tri	Al^{3+}
Silicon	4	tetra	Si^{4+}
Sulphur	2	di	S^{2-}
Chlorine	1	mono	Cl^{1-}
Neon	0	zero	_







An ion is an atom that lost or gained one or more electron.

1. A positive ion is an atom that lost an electron while a negative ion is an atom that gained an electron.
2. Metals form positive ions while non-metals form negative ions.

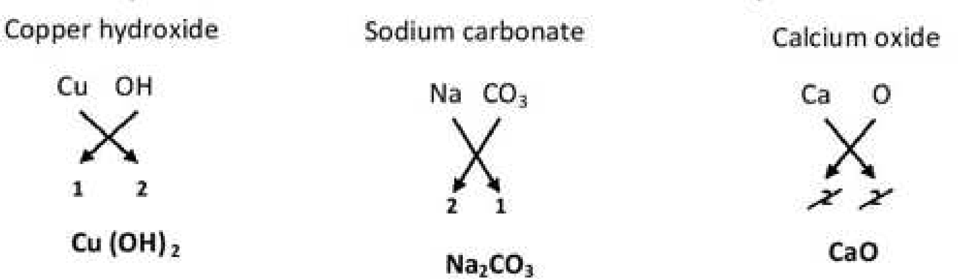
Monovalent		Divalent		Trivalent	
Hydrogen	H^+	Magnesium	Mg^{2+}	Aluminium	Al^{3+}
Sodium	Na^+	Calcium	Ca^{2+}	Iron III	Fe^{3+}
Potassium	K^+	Barium	Ba^{2+}	Nitrogen	N^{3-}
Floride	F^+	Copper II	Cu^{2+}		
Silver	Ag^+	Iron II	Fe^{2+}		
Chloride	Cl^-	Zinc	Zn^{2+}		
Bromide	Br^-	Lead II	Pb^{2+}		
		Oxygen	O^{2-}		
		Sulphur	S^{2-}		

An atomic group is a group of atoms that are bonded together & go into chemical reactions as one atom.

Atomic groups	Formula	Valency
Hydroxide	$(OH)^-$	1
Nitrate	$(NO_3)^-$	
Nitrite	$(NO_2)^-$	
Bicarbonate	$(HCO_3)^-$	
Ammonium	$(NH_4)^+$	
Carbonate	$(CO_3)^{2-}$	2
Sulphate	$(SO_4)^{2-}$	
Phosphate	$(PO_4)^{3-}$	3

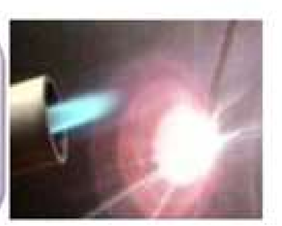
Writing chemical formulas

1. The symbol of the metal or the positive atomic group or hydrogen is written on the left.
2. The symbol of the non-metal or the negatively charged group on the right.
3. The valency of elements or atomic groups is exchanged & written below them.
4. If the valency is 1 , it's not written. Abbreviate whenever possible.



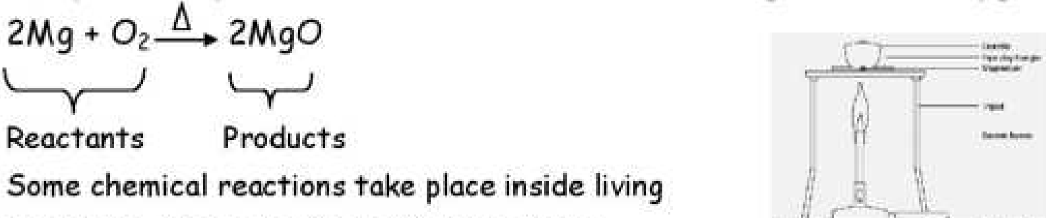
Chemical Reactions

1- Definition: A Chemical reaction involves the breaking of bonds in the molecules of the reactants & forming new bonds in the molecules of the products.



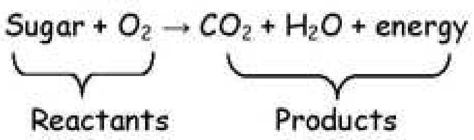
2- Some examples of chemical reactions:

- You previously studied the reaction between Magnesium & Oxygen



- Some chemical reactions take place inside living organisms, these are biochemical reactions.

  An example of a biochemical reaction is the burning of sugar in the body.



- In green plants, the reaction between carbon dioxide & water produced the food for the plant, a process called photosynthesis.
- In the car engine, gasoline burns with Oxygen producing heat energy , CO_2 & water vapor.

$$\text{Gasoline} + O_2 \xrightarrow{\text{Burnin}} \text{heat energy} + CO_2 + H_2O$$

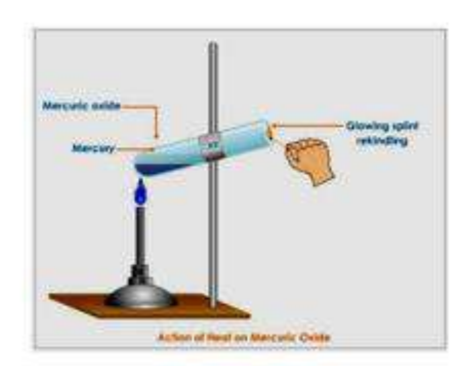
- Chemical industry uses various chemical reactions to produced new substances such as fertilizer, medicines & artificial fibers.
- A chemical equation expresses a chemical reaction. The reactants are written first on the left, followed by an arrow .the products are written on the right.

❖ Types of reactions:

A. **Thermal decomposition reactions,** where a compound is broken by heating into a simpler compound or into its elements.

Examples:

1. Some metal oxide decompose by heating into metal & oxygen. Oxygen makes a splint glow.



$$2HgO \xrightarrow{\Delta} 2Hg + O_2 \uparrow$$

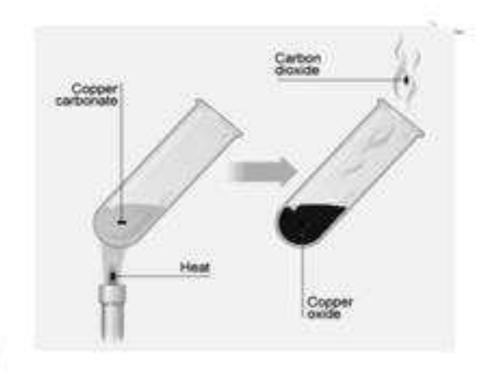
red mercuric (Oxide) → Mercury (Silver colored)

2. Some metal hydroxides decompose by heating into metal oxide & water.

$$Cu(OH)_2 \xrightarrow{\Delta} CuO + H_2O$$

Copper hydroxide (blue) → Copper oxide (black)

3- Most metal carbonates decompose by heating into metal oxide & carbon dioxide.



$Cu\,CO_3 \xrightarrow{\Delta} CuO + CO_2$

Copper carbonate (green) — Copper oxide (black)

4- Most metal sulphates decompose by heating into metal oxide & sulphur trioxide.

$Cu\,SO_4 \xrightarrow{\Delta} CuO + SO_3$

Copper sulphate — Copper oxide — sulphur trioxide

5- All metal nitrates decompose by heating into metal nitrite & oxygen gas.

$2Na\,NO_3 \xrightarrow{\Delta} 2Na\,NO_2 + O_2 \uparrow$

Sodium nitrate — Sodium nitrate

white — yellowish white

B. <u>Substitution reactions:</u>

- Metals are arranged in the chemical activity series descendingly according to the rate of chemical activity.
- A simple substitution reaction occurs when a metal replaces a less active metal in its compound.
- Metals that follow hydrogen don't replace hydrogen in an acid except under certain chemical conditions.

Examples of simple substitution reactions:

$Mg + CuSO_4 \rightarrow MgSO_4 + Cu$

Mg is stronger than Cu & precedes it in the series.

- Only metals above hydrogen replace it in the acid.

  $2Zn + 2HCl \rightarrow ZnCl_2 + H_2 \uparrow$

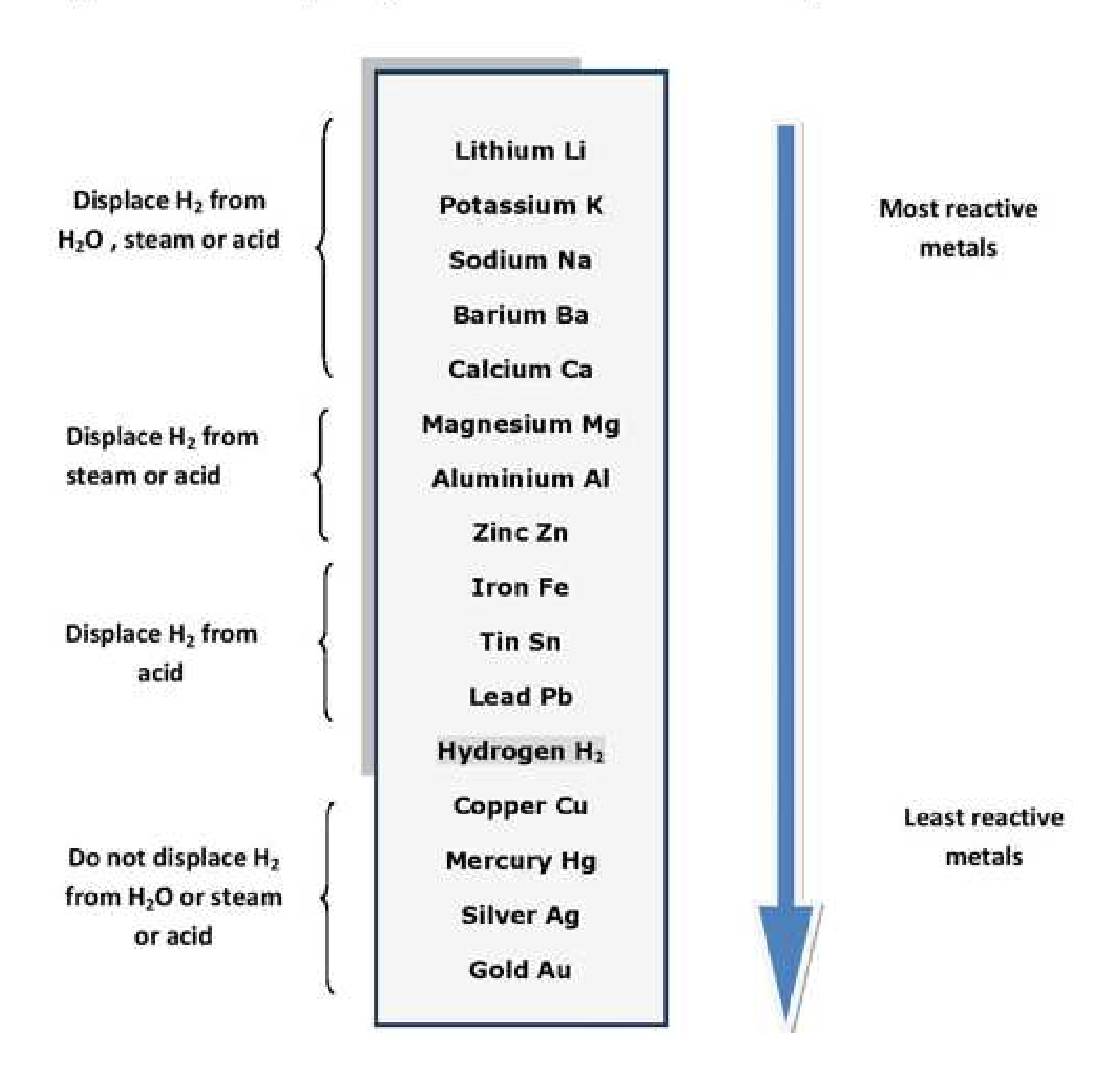
  Zn is above H_2 in the activity series.

  $Na + H_2O \rightarrow NaOH + H_2 \uparrow +$ heat.

  Sodium — Sodium hydroxide

  $Cu + HCl \rightarrow$ No reaction.

Copper is below hydrogen in the chemical activity series.



Activity 1:

Purpose: To compare the strength of reaction of different metals (Copper - Zinc - Aluminum) & hydrochloric acid.

Tools:

- 3 Beakers that contains equal amounts of dilute hydrochloric acid.
- Equal amounts of aluminum, copper turnings & zinc.

Observation:

- Copper doesn't react with the acid.
- Zinc takes some times then it reacts with the acid.
- Aluminum reacts with the acid immediately.



Copper in hydrochloric acid

Conclusion:

$Cu + HCl \rightarrow$ No reaction

$Zn + 2HCl \rightarrow ZnCl_2 + H_2\uparrow$

Zinc chloride (salt)

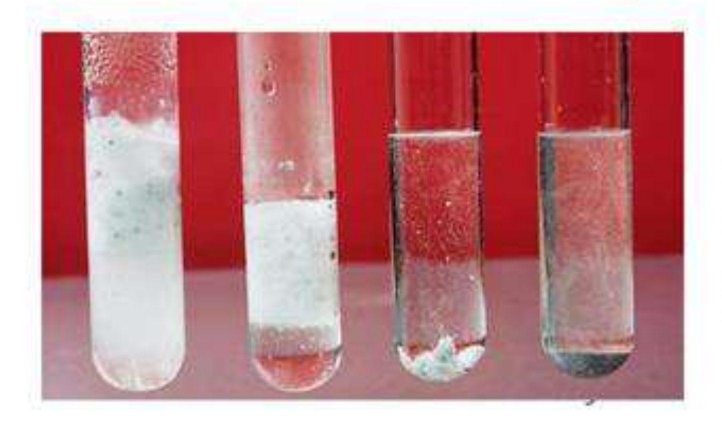
$2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2\uparrow$

Aluminum chloride (salt)

- A strong metal replaces the weak metals in its salt solution.

$Mg + CuSO_4 \rightarrow MgSO_4 + \downarrow Cu$

Magnesium — Copper sulphate (blue) — Magnesium sulphate — Copper reddish (brown)

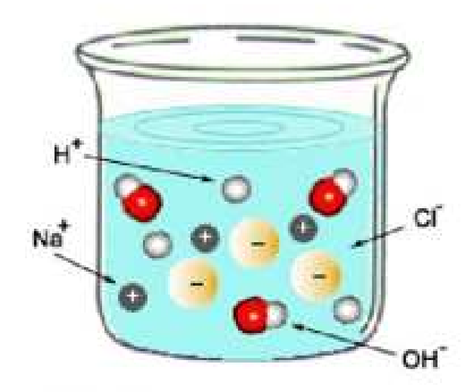


Dilute hydrochloric acid reactions. From left, calcium, magnesium, zinc and iron reacting with dilute hydrochloric acid. This reaction produces a metal salt and hydrogen

Double substitution:

It accurs when two compounds in aqueous solution exchange ions & form two new compounds.

Example:



1- Reaction between acid & alkali (neutralization)

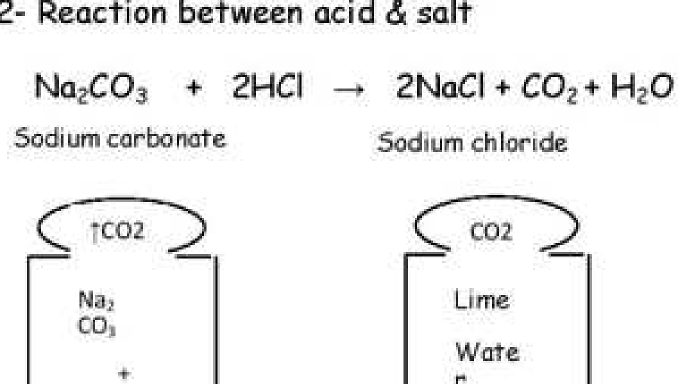
Acid + alkali → salt + water

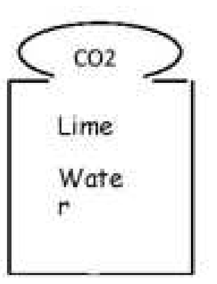
$HCl + NaOH \rightarrow NaCl + H_2O$

2- Reaction between acid & salt

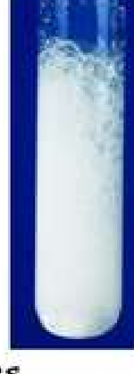
$Na_2CO_3 + 2HCl \rightarrow 2NaCl + CO_2 + H_2O$

Sodium carbonate — Sodium chloride





Lime water becomes turbid

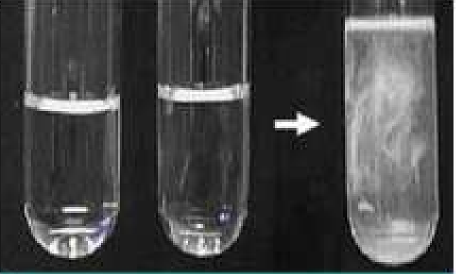


(Na_2CO_3) salt reacting with dilute (HCl) in a test tube. This reaction produces bubbles of CO_2

3- Salt solution with another salt solution.

$NaCl + AgNO_3 \rightarrow NaNO_3 + AgCl\downarrow$

Silver nitrate — Sodium nitrate — Silver chloride white precipitate

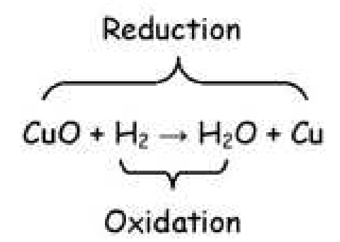


Double displace ment reaction forming precipitate

Oxidation & reduction:

Oxidation is a reaction which increases the oxygen content in a substance.

Reduction: is a reaction which decreases the oxygen content in the substance.



Term	Definition
Oxidation	A reaction where oxygen content in a substance is increased or hydrogen content is decreased
Reduction	A reaction where hydrogen content in a substance is increased or oxygen content is decreased
Oxidizing agent	A substance which gives oxygen or gains hydrogen in a reaction
Reducing agent	is a substance that gains oxygen or hydrogen in a chemical reaction.

Oxidation & reduction reactions may not involve oxygen or hydrogen as in the following reaction.

$2Na + Cl_2 \rightarrow 2NaCl$ **Table salt**

This reaction involves gain & loss of electrons

$2Na \rightarrow 2Na^+ + 2e^-$ (loss of electrons is oxidation)

(2,8,1) (2,8)

Electronic configuration

$Cl_2 + 2e^- \rightarrow 2Cl^-$ (gains of electrons is reduction)

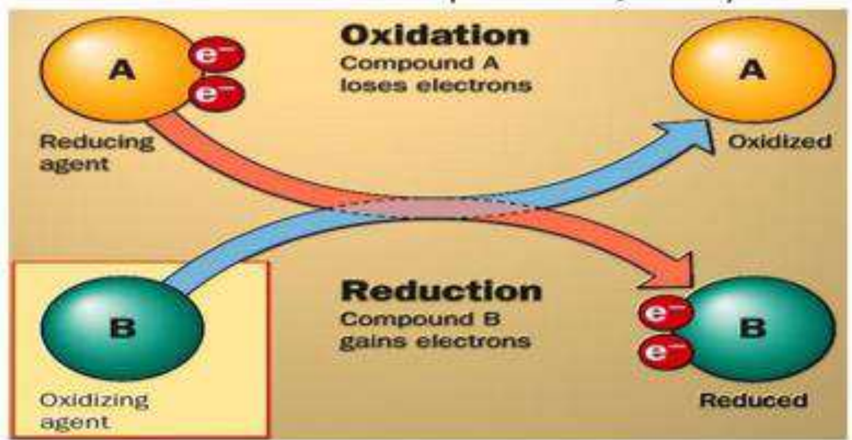
(2,8,7) (2,8,8)

, ı reaction may also be defined as follows:

Term	Definition
Oxidation	Loss of electrons in a reaction.
Reduction	Gains of electrons in a reaction.
Oxidizing factor	The substance which gains electrons in a reaction.
Reducing factor	The substance which lost electrons in a reaction.

Notes:

- The oxidizing agent is reduced in the reaction.
- The reducing agent is oxidized in the reaction.
- Oxidation & reduction are concurrent processes. (i.e. they occur together)



SCIENCE

Work sheets

Lesson one: Chemical reactions

Question one: complete the following statements:

1) ……….. gas turbid the lime water, while ………….. gas helps in burning.
2) By heating copper hydroxide, its color changes from …………….. into ………….
3) Sodium nitrate decomposes by heat into …………. and ……………, while ………… salt decomposes into copper oxide and sulpher trioxide gas.
4) When sodium reacts with water , ……….. gas evolves , while …………. gas evolves by heating of blue copper sulphate.
5) The changing of the (Mg) into (Mg^+) is considered …………… process , while the changing of (O^-) into (O) is considered ………….. process.
6) When the hydrogen gas passes on a hot copper oxide , copper oxide changes to be …………. and ………… is formed.
7) The reaction of salt solutions together is considered as ……….. reactions , which accompanied with the formation of …………..
8) In the following reaction " $H_2 + CuO \longrightarrow H_2O + Cu$, hydrogen gas is considered as …………… agent while copper oxide is considered as …………. agent.
9) The metals is arranged descendingly according to ………………. in the chemical activity series.
10) $2Na + 2H_2O \rightarrow$ ……. + H_2 + ……….
11) $2Al + 6HCl \rightarrow$ ……….. + …………..
12) Na_2CO_3 + …………. $\rightarrow$ $2NaCl$ + ……….. + ………..

Question two: What is meant by each of the following?

1) Chemical reaction.
…………………………………………………………………………………………
2) Simple substitution reactions.
…………………………………………………………………………………………

3) Double substitution reactions.

……………………………………………………………………………………

4) Oxidation (two definitions)

……………………………………………………………………………………

……………………………………………………………………………………

5) Reduction (two definitions)

……………………………………………………………………………………

……………………………………………………………………………………

6) Oxidizing agent (two definitions)

……………………………………………………………………………………

……………………………………………………………………………………

7) Reducing agent (two definitions).

……………………………………………………………………………………

……………………………………………………………………………………

8) Neutralization.

……………………………………………………………………………………

<u>Question three: Choose the correct answer:</u>

1) ………… metal doesn't replace the hydrogen of the diluted acids.

(Magnesium – silver – zinc – iron)

2) Which of the following substances doesn't produce black product?

(HgO – $Cu(OH)_2$ – $CuSO_4$ – $CuCO_3$)

3) Active metals replace the hydrogen of the water and ………… produce.

(Metal oxide – metal hydroxide – metal carbonate – metal sulphate)

4) In the oxidation reduction reactions , the number of the loosed electrons are ………….. the gained electrons. (More than – less than – equal to)

5) When potassium reacts with diluted hydrochloric acid , hydrogen gas evolves and ………….. salt is formed.

(potassium nitrate – potassium sulphate – potassium chloride – potassium hydroxide)

6) Oxidation and reduction are …………. processes.

(concurrent – separated – no correct answer)

Lesson 2:
Speed of chemical reactions

Introduction:

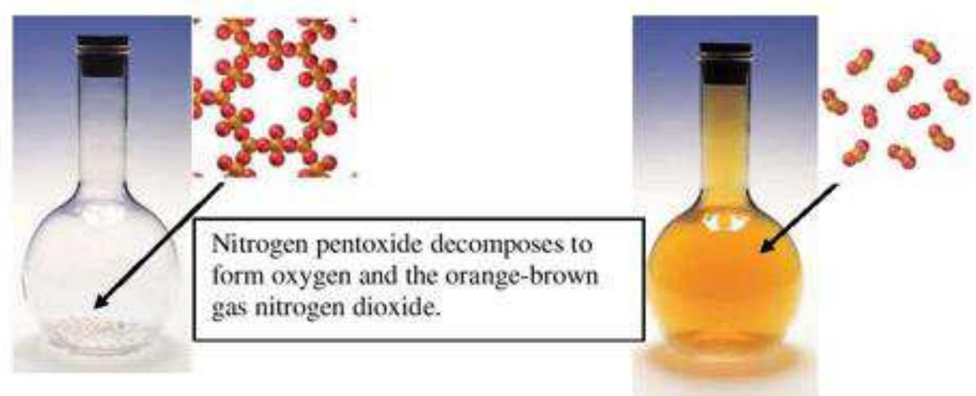
- A chemical reaction changes a substance into another substance.
- The speed of a chemical reaction measures how quickly reactants are changed into products.
- Some reactions occur in a short time such as fireworks.
- The reaction between oil & caustic soda takes long time.
- Iron rusting also takes long time to occur.
- The reactions which form petroleum oil in the earth take millions of years.

The following reaction:

$2N_2O_5(s) \rightarrow 4NO_2\ (g) + O_2\ (g)$

Nitrogen pentoxide decomposes to give nitrogen dioxide & oxygen.

Over time, the concentration of the reactants decreases the concentration of the products increase.

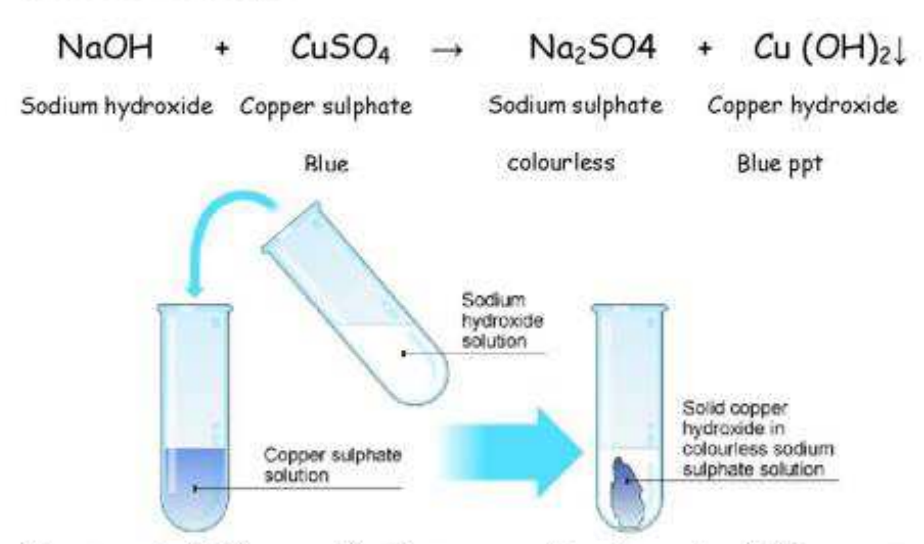


Concentration is: The strength of a solution; it's the number of molecules of a substance in a given volume.

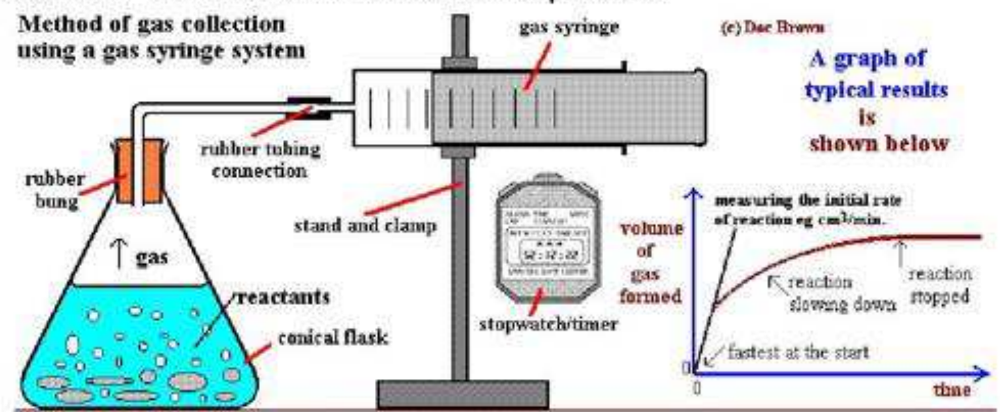
Definition: The speed of chemical reaction is the change in the concentration of reactants & products in a unit of time.

Another example:

$NaOH$	+	$CuSO_4$	→	Na_2SO4	+	$Cu\ (OH)_2\downarrow$
Sodium hydroxide		Copper sulphate		Sodium sulphate		Copper hydroxide
		Blue		colourless		Blue ppt



The speed of this reaction is measured by the rate of disappearance of the reactants or the rate of formation of the product.



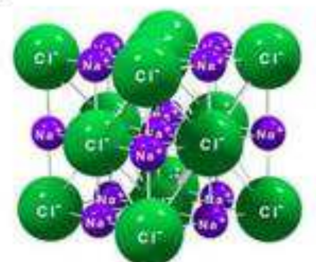
Many factors affect the speed of chemical reactions, such as:

- The nature of reactants (the bonds in the molecules, area of reactants exposed to reaction).
- The concentration of reactants
- The temperature of reactants
- Catalysts

1- The nature of reactants:

Covalent compounds such as organic compounds react slowly because they don't break into ions.

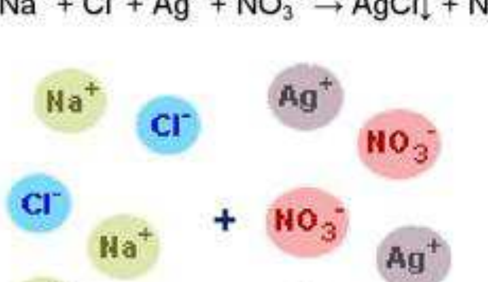
Ionic compounds react fast because they break into ions.



Example:

$NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$

$Na^+ + Cl^- + Ag^+ + NO_3^- \rightarrow AgCl\downarrow + Na^+ + NO_3^-$



<u>Activity1:</u>

Purpose: To prove the effect of surface area on the speed of chemical reaction.

Tools: 2 Test tubes which contain equal amounts of hydrochloric acid. Some iron filing & an equal amount of iron.

Step:

Add the iron filing to one test tube & add the piece of iron to the other test tube.

Observation:

The reaction in the first test tube iron filings is faster than the reaction in

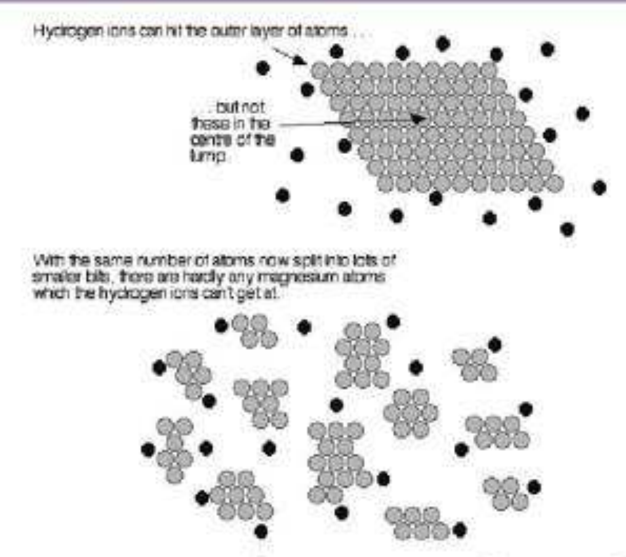
the 2nd test tube (piece of iron)

Conclusion:

The area of iron exposed to reaction in case of iron filing is bigger & therefore the reaction is faster.

$Fe + 2HCl \rightarrow FeCl_2 + H_2 \uparrow$

Increasing the surface area of reactants exposed to the reaction increases the speed of chemical reaction.



The effect of the concentration of reactants on the speed of reaction:

Consider the burning of aluminum coil in the following cases.
In A, aluminum burns with O_2 found in the air. (O_2 is 21% of atmospheric air).
In B, aluminum burns in a container which contains pure O_2.



Observation:

Aluminum reacts faster in case B.

Conclusion:

As concentration of the reactant increases, more collision between molecules take place & therefore the rate (speed) of reaction increases.

Activity 2:

Purpose: To prove the effect of the concentration of reactants on the speed of reaction.

Tools: Test tube A contains dilute hydrochloric acid, 2 magnesium ribbons of the same size.

Procedure:

Put a piece of magnesium ribbon in each test tube.

Observation:

There're more bubbles in test tube B .

Conclusion:

- The speed of chemical reaction increases when the concentration of the reactants increase.

A

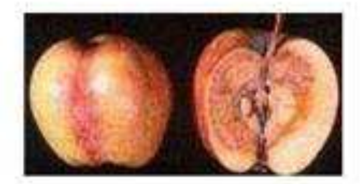
B

The effect of temperature on the speed of reaction.

- Increasing the temperature increases the rate of chemical reaction because the number of collisions between molecules increase.
- Bacteria spoil food through chemical reactions. That's why food is cooled or frozen to slow the rate of this reaction & stop spoiling.

Bacteria





- A cook increases the temperature to speed up the chemical reactions that help cooking the food.

Activity 3:

To prove the effect of heat on the rate of reaction.

Beaker (A)



Hot water + effervescent tablet

Beaker (B)



cold water + effervescent tablet

The great number of bubbles in beaker A indicates that rate of reaction is higher in beaker A.

A catalyst is a substance which speeds up chemical reaction without sharing in it.

reactions.

The properties of catalysts:

1- They change the rate of the reaction without changing the reactants & products.

2- The mass of the catalyst isn't changed by the reaction.

3- The catalyst isn't changed chemically.

4- The catalyst combines with the reactants & separates from the products at the end of the reaction.

5- The catalyst is used in small amount.

6- The catalyst decreases the energy needed for the reaction.

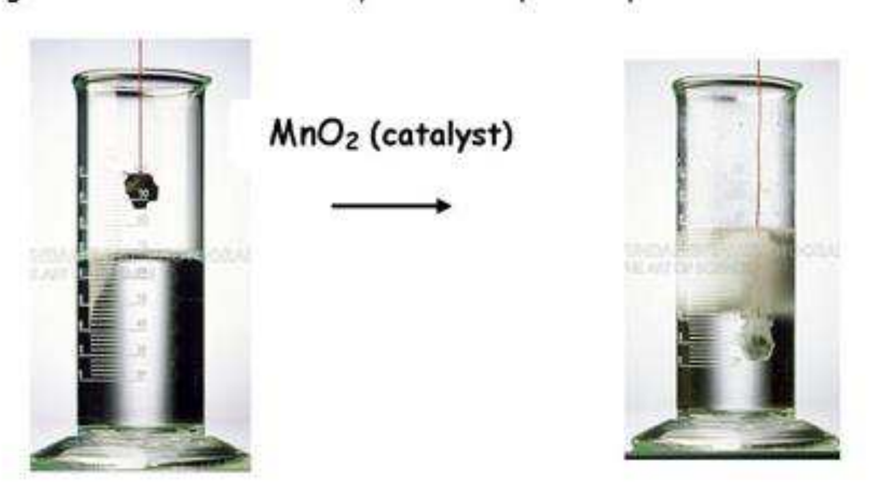
Activity 4 to show the effect of the catalyst on the rate of reaction.

Manganese dioxide (catalyst)

$$2H_2O_2 \xrightarrow{MnO_2} 2H_2O + O_2\uparrow$$

Hydrogen peroxide → water + oxygen

- Manganese dioxide is a catalyst which speeds up the reaction.



Activity 5: To show the effect of enzymes on the rate of reaction.

- An enzyme is a biological molecule which acts as a catalyst. An example of an enzyme is the oxidize enzyme found in sweet potato.

-Oxidise enzyme in the sweet potato speeds up the breaking of hydrogen peroxide.





Inside the human body:

- Our body contain different enzyme to catalyze different bio chemical reactions in the cells. Each enzyme catalyzes a specific reaction. Without enzyme the reactions that digest food & release energy will slow down & the body will not perform these vital processes.
- The enzyme molecule can break up millions of molecules of the reactants.



Saliva secreted in the mouth contains an enzyme which digests starch

SCIENCE

Work sheets

Lesson two: Speed of chemical reactions

Question one: Complete the following diagram:

Speed of chemical reaction mean:

……………………………………………………………………………
……………………………………………………………………………

and it affects by:

………… …………	………… …………	………… …………	………… …………	………… …………

………… ………… or ………… …………

Slow Fast

Where the collisions between molecules increases

Question two: Give reasons for :

1) Chemical reactions are different in their speeds.

……………………………………………………………………………………………
……………………………………………………………………………………………

2) Reaction of sodium chloride with silver nitrate is fast.

……………………………………………………………………………………………

3) The reaction hydrochloric acid with iron filings is faster than the reaction with the iron piece.

…………………………………………………………………………………………

…………………………………………………………………………………………

4) You should chew the food well before swallowing.

…………………………………………………………………………………………

…………………………………………………………………………………………

5) The increase in the concentration of reactants leads to the increase in the speed of the chemical reaction.

…………………………………………………………………………………………

…………………………………………………………………………………………

6) The non frozen food spoilt quickly.

…………………………………………………………………………………………

…………………………………………………………………………………………

<u>Question three: In the following figure , answer :</u>

- The two boxes are equal in their volumes.
- Box (1) contains less amount of oxygen than box (2).
- In which box does the aluminum burn quickly? Why?

…………………………………………………

…………………………………………………

…………………………………………………

…………………………………………………

- Mention other factors affecting the speed of the chemical reactions.

…………………………………………………………………………………………

…………………………………………………………………………………………

<u>Question four: Write shortly about the catalysts.</u>

…………………………………………………………………………………………

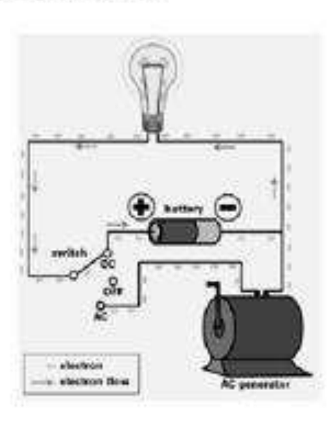
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Unit 2:Electric energy & radioactivity

Lesson 1: The physical properties of the electric current.

Lesson 2: Electric current & cells.



Lesson 3:Radioactivity & nuclear energy.



Uranium



Lesson 1: The physical properties of the electric current

Electricity:

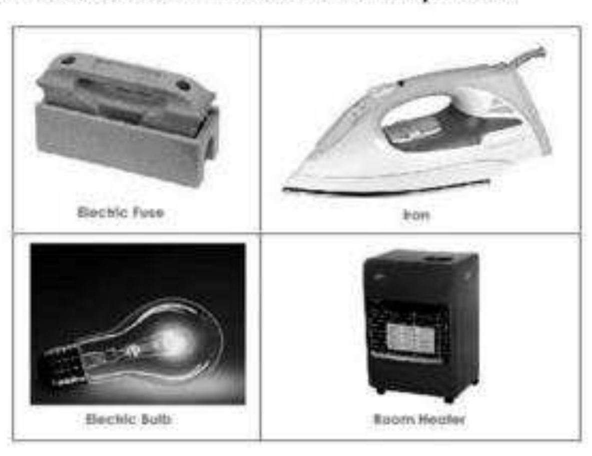
You can see the effects of electricity when electric energy is changed into another form of energy as follow:

a. Electric energy is changed to light in electric lamps.

b. Electric energy is changed to heat in electric heaters & irons.

c. Electric energy is changed to mechanical energy in electric motors.

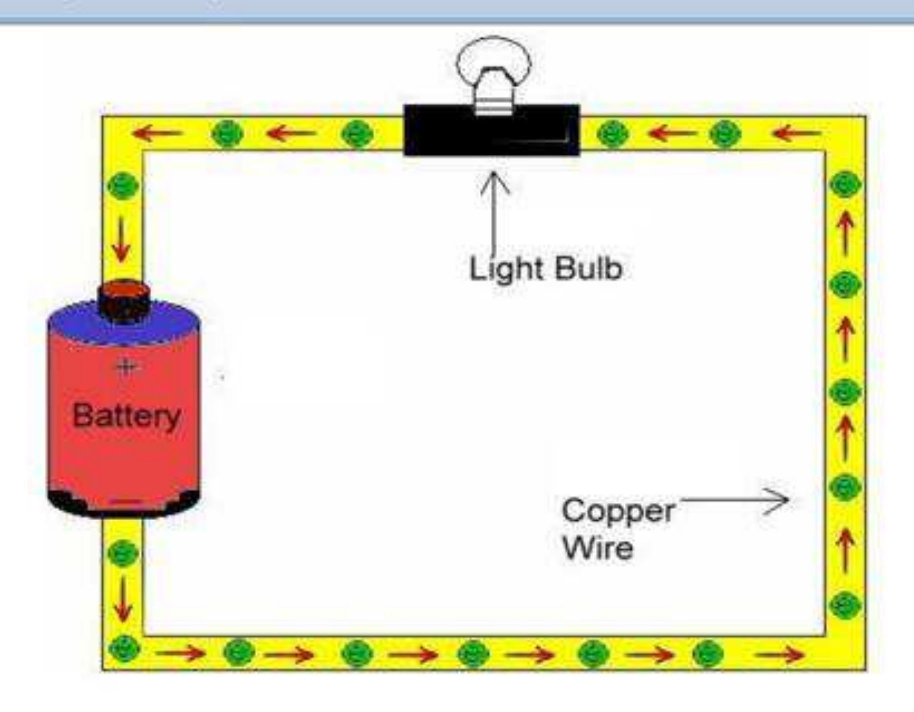
d. Electric energy is changed to sound in the radio, cassette recorder & telephone .



Generating an electric current :

- Consider a wire of copper . The atoms contain positively charged protons in the nucleus.
- Negatively charged electrons revolve around the nucleus.
- Attraction forces between the protons & electrons keep them together . electrons in the last energy level are weakly attracted to the nucleus.
- Electrons in the last energy level can flow from an atom to another.
- If the copper wire is connected in a closed circuit with a battery, an electric current composed of free electrons will flow in the circuit.

Definition:
The electric current is the flow of negative charges (electrons) in a conducting substance (metal wire)



1- Electric current intensity.

Definition	Quantity of electric charges flowing through a cross. Section of the conductor in one second.
The instrument used to measure it	The ammeter (A).
Unit	Ampere
Mathematical relationship	Current intensity = $\frac{\text{quantity of charge}}{\text{time}}$

Definition of Ampere:
It is the current intensity when 1 coulomb of charge passes through the cross section of the conductor in one second.

A solved problem:

5400 Coulomb passed through a conductor in 5 minutes.

Calculate the current intensity.

Time in s = 5 min. X 60 second = 300 s



$$I = \frac{\text{Charge}}{\text{Time}}$$

$$I = \frac{5400}{300} = 18 \text{ ampere.}$$

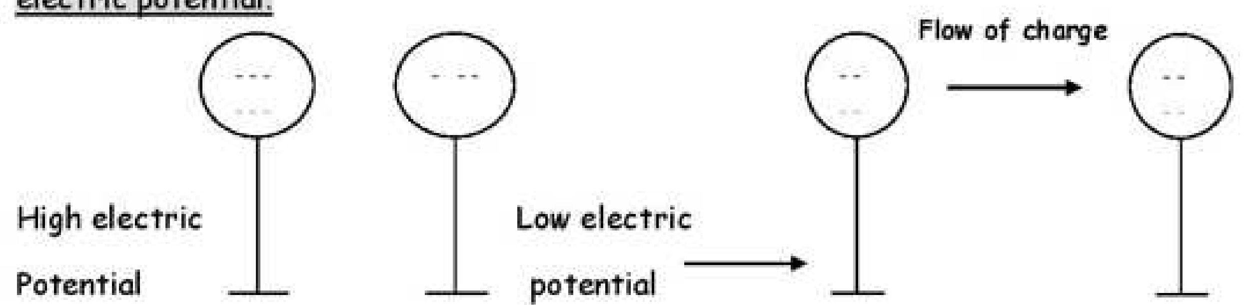
The ammeter is connected in the electric circuit in series so that the measured current must pass through the meter.

2- Electric potential difference :

Definition:

It's the state of the electric conductor which determines the transfer of electricity to or from the conductor when connected to another conductor.

When two charged conductors touch & they have different potentials, electric charge flows from the conductor with high electric potential to the conductor with low electric potential.



Some useful terms & their definitions

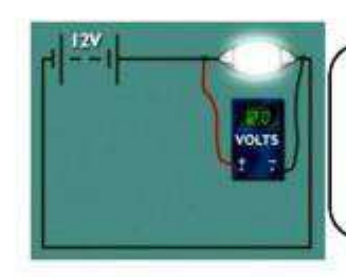
Term	Definition
1- Joule (unit of work)	It's the work done by a force of one newton to transfer an object a distance equal 1 meter.
2- Potential difference	It's the work done to transfer a quantity of electric charge between the two ends of this conductor. Potential difference = $\frac{\text{Work (joule)}}{\text{Charge (coulomb)}}$
3- Volt (unit of difference)	It's the potential difference between the two poles of a conductor where 1 joule is done to transfer 1 coulomb of charge.
4- Coulomb (unit of electric charge)	It's the charge transferred by a constant current of one ampere in one second.
5- Electromotive force emf	Electric potential difference between the two poles of the battery when the electric circuit is open. It's unit is volt.

Measuring potential difference:

- The voltmeter is the device that measures potential difference & electromotive force. Its symbol is -(V)-
- The voltmeter is connected in the circuit in parallel to prevent the current from passing through the voltmeter.

The voltmeter is used to measure the emf .





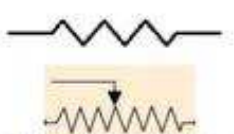
The voltmeter is used to measure potential difference across the lamp.

3- Electric resistance R :

- Definition : the obstruction to the flow of the current in the electric circuit.
- It's measured by an instrument called <u>ohmmeter.</u>
- It's unit is the ohm.
- Definition of ohm : it's the resistance of the conductor to the flow of a current of 1 ampere where the potential difference is 1 volt.

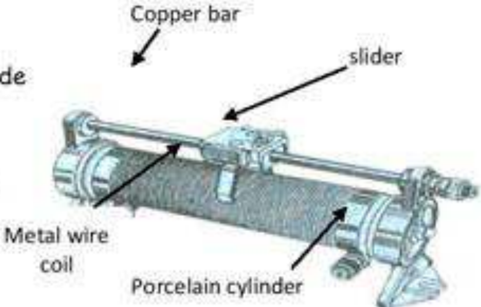
Resistance has 2 types:

a- Constant, its symbol is
b- Variable , its symbol is



The variable resistance also known as the sliding rheostat can be changed to adjust the value of the current & potential difference in the circuit.

The components of the variable resistance:



a. Metal wire of high resistance wrapped around a cylinder made

Of an insulator such as porcelain.

b. A copper sheet that can slide over the whole length of wire called the slider.

How the variable resistance operates:

- Changing the length of the wire changes its resistance.
- Increasing the length of the wire increases the resistance & decreases the current intensity.
- Decreasing the length of the wire decreases the resistance & increases current intensity .

Enriching information

- The car's fuel scale is connected with a variable resistance that controls the flow of electric current . The change in the level of fuel in the tank affects the resistance & the current passing in the scale & causing the deviation of the pointer.
- The relation between current intensity & potential difference.

Ohm's law

Procedure:

1- From an electric circuit as in the figure.
2- Close the circuit & change the position of the slider in the Rheostat.
3- Record the value of I (current intensity) & the correspondent V (potential difference).
4- Change the resistance & take the values of I & V several times.

Current intensity I (amperes)	Potential difference V (volt)	$\frac{V}{I}$

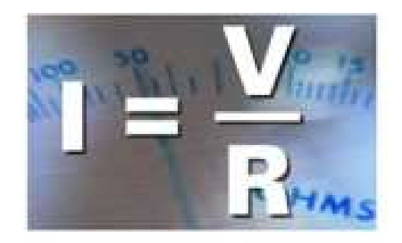
Conclusion :

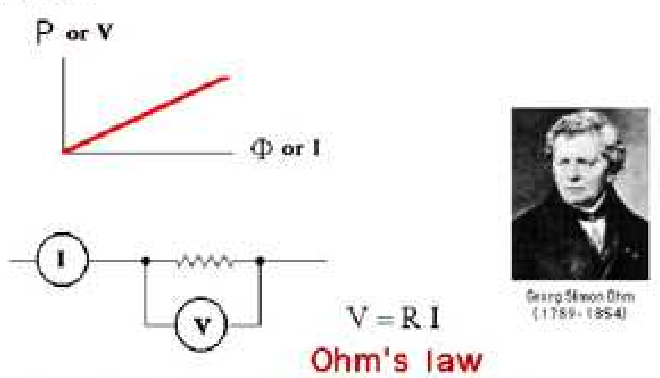
- The ratio V/I is constant equal to the conductor's resistance.
- The symbol of resistance is R & its unit is ohm.
- **Ohm's law:** Current intensity is directly proportional to the potential difference across the ends of the conductor at constant temperature.
- **Resistance can be defined as the ratio between potential difference between the two ends of a conductor & current intensity passing through it.**

Some important definitions

Term	Definition
Ohm	The resistance of a conductor where the current intensity is one ampere & its potential difference is one volt.
Ampere	It's the current intensity in a conductor whose resistance is one ohm & its potential difference is one volt.
Volt	It's the potential difference between the two poles of a conductor whose resistance is one ohm & the current intensity is one ampere.

Mathematical representation of ohm's law





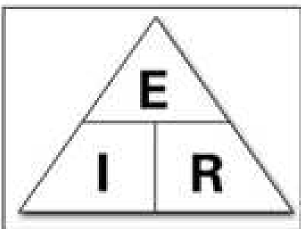
A solved problem :

The intensity of a current is 20A passes through a heater where the potential difference is 220 volt calculate the heater's resistance.

$$R = \frac{V}{I}$$

$$R = \frac{220}{20} = 11 \text{ Ohm}$$

Use the triangle whenever you have the value of 2 variable to find the third :



Note :

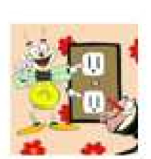
The unit of resistance & ohm's law are named after the German scientist George Simon ohm who discovered the quantitative properties of the electric current.

SCIENCE

Work sheets



Lesson one: Physical properties of the electric current



Question one: Complete the following statements:

1) Electric current can be used in the ……………………… , ……………………….. and ……………………………
2) When the force of the nucleus becomes weak or stopped so ………………… becomes free and flow in the electric conductor.
3) The electric current is ……………………………………………………………………………………
4) The physical properties of the electric current are ………………… , ………………. and …………………….
5) Current intensity is …………………………………………………………………………………….
6) The electric current can be detected in the circuit by using …………………………
7) Current intensity = ……………………… ÷ ……………………..
8) Ammeter is connected in ………………… in the circuit.
9) The current intensity that flows in the circuit when the amount of charges is 1 coulomb and the time needed is 1 second is called ………………….
10) The electric potential is …………………………………………………………………………
11) The potential difference is ……………………………………………………………………….
12) The transfer of electric charges from electric conductor to another depends on the ……………………………………
13) The electric potential difference is measured by the ……………………….. apparatus and ……………………… unit.
14) The work done to transfer electric charges is measured by …………. unit.
15) Coulomb is ………………………………………………………………………………………………
16) Voltmeter is used to measure …………………………… and ………………………..
17) Voltmeter is connected in ………………… in the circuit.
18) The potential difference between the two poles of the battery when the circuit is opened is called ………………………….
19) Volt is …………………………………………………………………………………………………

20) Ammeter is symbolized with .... in the circuit , while voltmeter is symbolized with ....

21) The opposition that the current faces during its motion in the wires is called ....

22) The measuring unit of the electric resistance is ....

23) Ohm is ....

24) The two types of the electric resistance are .... and ....

25) The constant resistance is symbolized by .... in the circuit.

26) The rheostat is consists of .... , ... , ... and ....

27) The idea of operation of the electric rheostat depends on ....

28) The relation between the current intensity and potential difference is .... , while the relation between current intensity and resistance is ....

29) The value of the current intensity can be changed (controlled) by using .... apparatus.

30) The function of the electric resistance is ....

31) Ohm's law states that .... and its mathematical relation is ....

32) The ratio between the potential difference and the current intensity is called ....

33) The electric resistance value is changed in the circuit when the .... is changed.

Question two: Give reasons for:

1) The value of the current intensity increases if the time needed to transfer the charges decreases.

....

2) Some electrons become free when a conductor is connected with another.

....

3) Ammeter is connected in series in the electric circuit.

....

4) The value of the current intensity increases as the resistance decreases.

....

Lesson 2 :

Electric current & cells

The electric current is generated by 2 methods :

1- Changing chemical energy into electric energy in electrochemical cells (batteries).

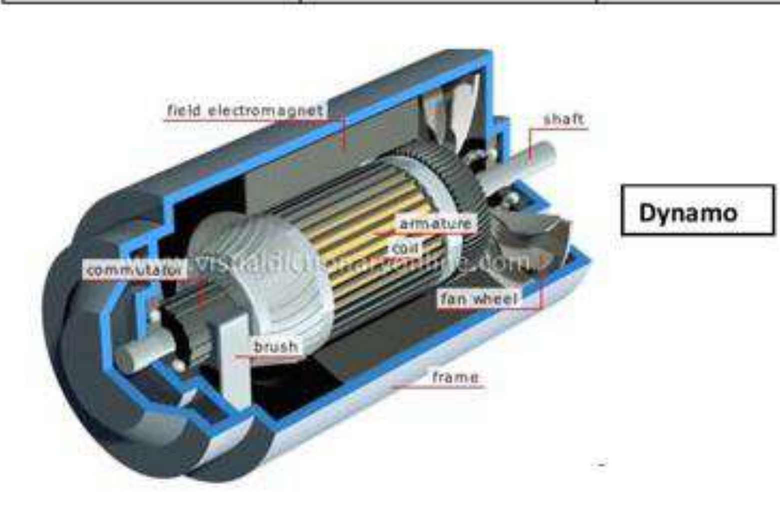
They produce direct current.

2- Changing mechanical energy into electric energy by the electric generator (dynamo).

The current produced is the alternating current.



Device	Energy used	Energy produced	Type of current
Electrochemical cell (batteries)	Chemical	Electric	Direct current
Generator (dynamo)	Mechanical	Electric	Alternating current



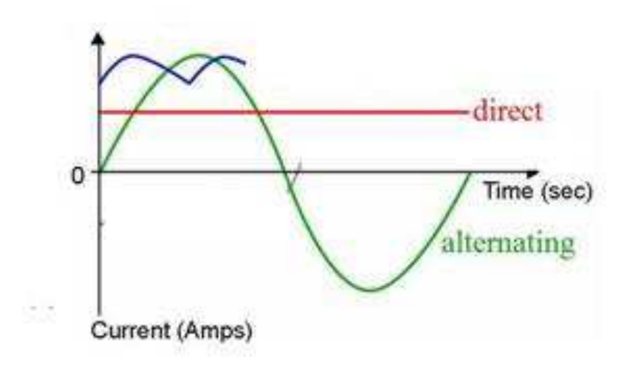
Dynamo



Types of electric current :

The following table compares the direct current with the alternating current:

Points of comparison	Direct current DC	Alternating current AC
Definition	It has constant intensity	It has variable intensities
Direction	It flows in one direction. (from one pole of the battery, then through the circuit towards the other pole of the battery).	It flows in opposite directions (alternates the direction)
Source	Electrochemical cells such as: - The simple cell. - The dry cell.	Electric generator (dynamo).
The distance it travels.	It's transferred over short distances.	Can be transferred over short & long distances.
Uses	Operating some electric machines such as torches & electroplating.	Lighting houses & streets & operating electric appliances at houses.
Conversion	Can't be converted into alternating current.	Can be converted into direct current.

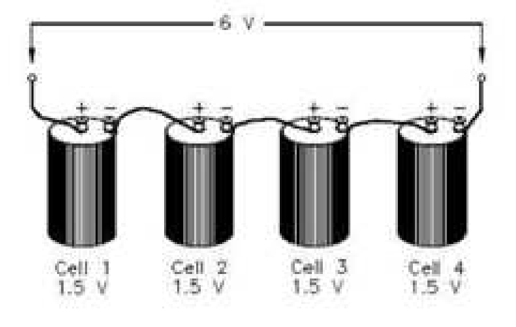


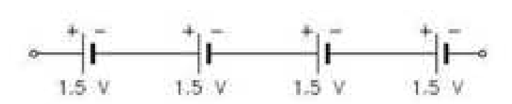
Connecting cells in an electric circuit

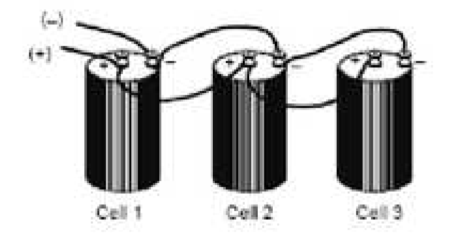
Cells are connected in the circuit by 2 methods: Series & parallel.

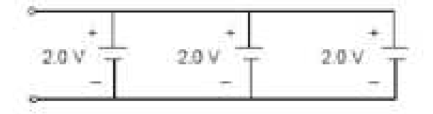
The following table is a comparison between the two methods of connection.

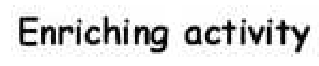
Points of comparison	Connecting cells in series	Connecting cells in parallel
Connection	The negative pole is connected to the positive pole of the 2nd cell & so on.	The positive poles are connected together, while the negative poles are connected together.
Emf	= the sum of emf of all the cells. $E = E_1 + E_2 + E_3 + E_4$	If the cells have the same emf = emf of one cell. $E = E_1$ or E_2 or E_3 since $E_1 = E_2 = E_3$.
A solved example	A circuit contains 4 cells connected in series. The emf of the battery = 4x1.5 = 6 volt.	A circuit contains 3 cells connected in parallel. emf = 2 volt













Make a lemon battery (then connect few lemon batteries in series & in parallel).

Material:

Fresh lemons, copper ribbons, lead ribbons, electric copper wires, paper clips, 2electric lamps.

Procedure :

1- Cut each lemon into 2 halves.

2- Insert a copper ribbon & a lead ribbon in each half lemon.

3- Put a paper clip at the free end of each ribbon.

4- Use electric wires to connect the lemon cells.

a- **In series:** connect the copper ribbon with the lead ribbon of the next lemon cell.

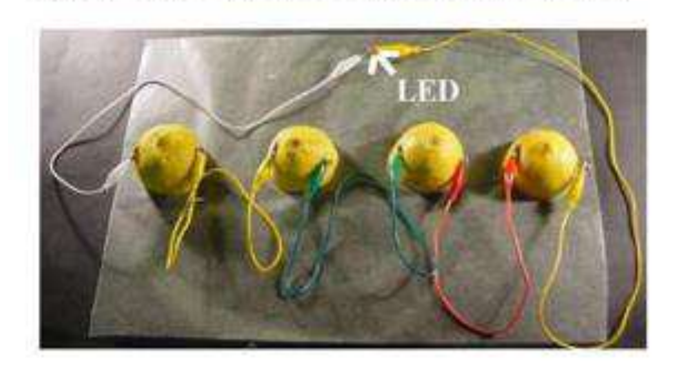
b- **In parallel:** connect the copper ribbons together then connect the lead ribbons together.

Observation: The lamp connected to the lemon cells connected in series has higher light intensity.

Conclusion:

When connecting batteries in series, the current intensity is higher than batteries connected in parallel.





Technological application

1- Electric transformers (voltage converters & adapters).

The electric voltage at home is 220 volt. Some electric devices operate by 110 volt, therefore using the electric supply will damage them.

A device known as step down transformer is connected with the appliance to reduce the potential difference of the current passing through it.

Types of transformers:

1- Step up which increase the voltage
2- Step which reduces the voltage

2- Uncut electric charger:

It stores electric energy for a certain period of time when electricity is cut, the charger can supply appliances with electric current for a while until the current is restored.

SCIENCE

Work sheets

Lesson two: Electric current and cells

Question one: put (√) or (×) and correct the wrong one:

1) Chemical energy can be changed into electric energy through the electric generators. ( )

2) The electric current that resulted from the electrochemical cells is known as alternating current. ( )

3) In dynamo, the mechanical energy is converted into electric energy. ( )

4) From the advantages of the A.C is its ability to be converted into D.C

5) A.C is resulted from waterfalls. ( )

6) Electrons flow in the D.C in two different directions. ( )

7) D.C is used in the lightning of the streets and electroplating. ( )

8) The electric cells are connected in the circuit is series only. ( )

9) The E.M.F of a battery increases when the cells are connected in parallel.

( )

10) The negative pole is connected with another negative in the battery. ( )

11) The E.M.F of a battery which their cells are connected in series is calculated from the relation (e.m.f of one cell × N). ( )

Question two: Compare in table between each of the following " use diagrams if it is needed" :

1- Alternating and direct currents.

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………

2- Connecting the cells in series and in parallel.

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

………………………………………………………………………………

3- The resulted (E.M.F) from the connection in series and in parallel.

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

………………………………………………………………………………

Question three: Give reason for each of the following:

1- Alternating current is preferable in using than direct current.

………………………………………………………………………………………

………………………………………………………………………………………

2- The reading of the voltmeter is changed if 4 cells are connected in series than in parallel.

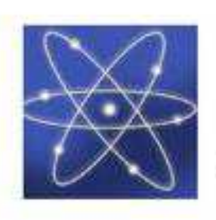
………………………………………………………………………………………

………………………………………………………………………………………

Question three: Show by drawing only:

1) The connection of 3 cells each of 1.5 volts to get an e.m.f with :

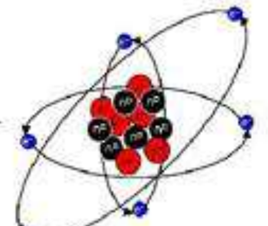
a. 1.5 volt b. 3 volt c. 4.5 volt



Lesson 3:
Radioactivity & nuclear energy

Introduction :

The structure of the atom :



- The atom consists of a nucleus which contains protons & neutrons.
- The nucleus is surrounded by electrons.
- Most of the mass of the atom is concentrated in its nucleus.
- Nuclear forces are forces which bind neutrons & protons in the nucleus to overcome the repulsion between protons in the nucleus.
- When the nucleus is bombarded in the nuclear reactor, the nuclear energy is released. This energy is huge & is used for different purposes.

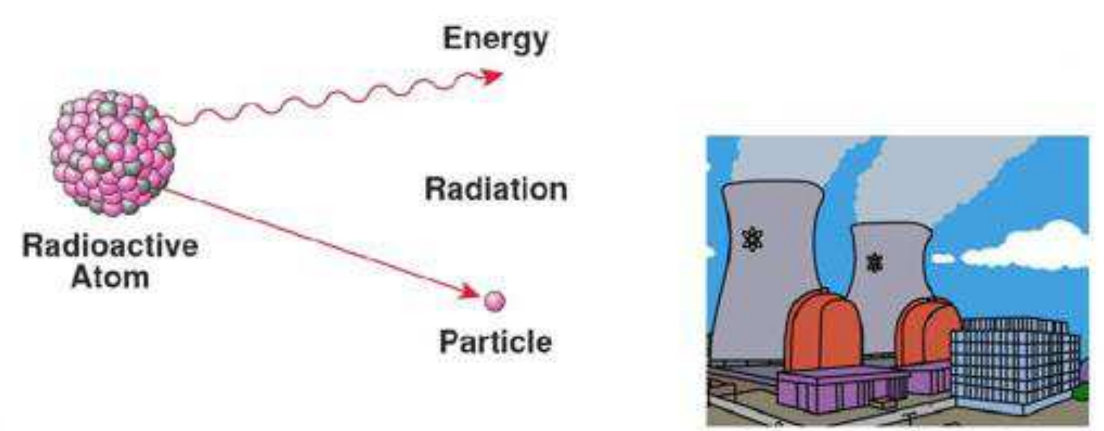
The discovery of radioactivity:

The French scientist Henry Becquerel discovered the emission of invisible rays from uranium. The rays penetrated solid objects.

Definition of radioactivity phenomenon;

Radioactivity is a spontaneous phenomenon where by the nuclei of certain elements (like uranium) radiate different rays or particles, therefore the unstable nucleus becomes stable.





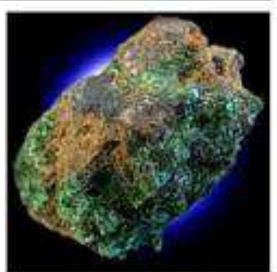
What're radioactive elements?

A radioactive element is an element with an unstable nucleus because the number of neutrons is higher than a certain number, therefore it radiates different radiations & gets converted to a stable element.

Radioactivity occurs either naturally or artificially:

Points of comparison	Natural radioactivity	Artificial radioactivity
Definition	It's the radiation produced from radioactive element in nature.	It's the radiation released during nuclear reaction.
Occurrence	In nature (example the rocks of the earth).	In the nuclear reactor, nuclear bomb.
Radioactive elements	Rubidium, selenium, yttrium, zirconium & strontium.	Uranium.

Uranium



Dr. Aly Moustafa Mosharafa.



Due to his excellence in mathematics, the Egyptian Ministry of Education sent him to England where he obtained college degree BSc with honors from the University of Nottingham in 1920.

He obtained a PhD in 1923 from King's College London in the shortest possible time permissible according to the regulations there. In 1924 Mosharafa was awarded the degree of DSc. He was the first Egyptian and 11th scientist in the entire world to obtain such a degree. The degree of Doctor of Science is one of the Higher Doctorates

He was the first Egyptian professor of applied mathematics in the Faculty of Science at Cairo University. He became dean of the faculty in 1936, at the age of 38.

He contributed to the development of the quantum theory as well as the theory of relativity and corresponded with Albert Einstein.

He published 25 original papers in distinguished scientific journals about the Quantum Theory, the Theory of Relativity, and the relation between radiation and matter.

He published around 12 scientific books about relativity and mathematics. His books, on the theory of relativity, were translated into English, French, German and Polish.

He Translated 10 books of Astronomy and Mathematics into Arabic. when Einstein visited Egypt, he specifically asked to meet Mosharafa, and it is said that this meeting developed onto Einstein's $E=MC^2$ because of Mousharafa's extraordinary knowledge of quantum atoms, radiation, mecahnics, and dynamics
He was against the use of atomic energy in war and warned against the exploitation of science as a means of destruction.

Peaceful uses of nuclear energy :

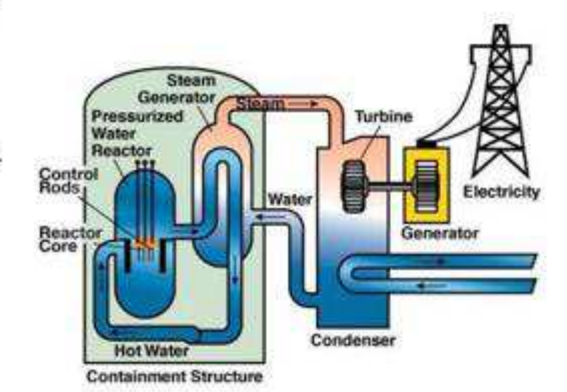
1- The medical field: diagnose & treat diseases like cancer.

2- The agricultural field: kill & eliminate pests & improve plants.

3- The industrial field:

- *Convert sand to silicon sheets used in manufacturing computer processors.*
- Programmed electric circuit used in electric appliances.
- Finding defects in manufactured products.

4- *Generating electricity:*



- The nuclear reactor releases a large amount of heat which is used to boil water.
- The steam produced turns turbines which operate the electric generator.
- In space exploration: nuclear fuel powers rockets.
- Drilling for petroleum oil & underground water.

The harmful effects of radioactivity:

Radioactivity has 2 sources:

a- Natural :

- The rocks of the earth.
- Cosmic radiation coming from outer space.

b- Artificial :

- The explosion of nuclear bomb.
- Nuclear reactors. An example: In 1986 the Chernobyl nuclear reactor in Russia exploded. This released radiations which were carried by the wind to surrounding European countries.
  When rain fell, the radioactive elements iodine & cesium were deposited in the soil.



- Decay of nuclear fuel uranium 235 during the Chernobyl accident produced atomic dust which fell on the soil by dry falling or by falling with rain to the earth. Herbivores (plant eating animals) such as cows & sheep feed on polluted plants. The radiation affects their milk & meat.



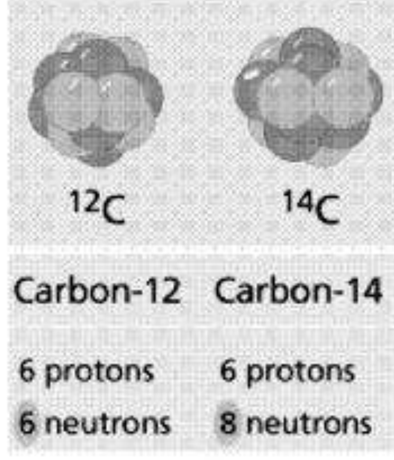

Chernobyl disaster

Radioactive isotopes :

When two nuclei have the same atomic number (no. Of proton + neutrons), then they're isotopes. Isotopes have the same chemical properties & different physical properties.

An example ;

Carbon has 2 isotopes ${}^{12}_{6}C$, ${}^{14}_{6}C$,the one with the two extra neutrons is radioactive & undergoes radioactive decay.



The dangers of exposure to radiation :

1- Exposure to a large does of radiation for a short time damages the digestive system, spleen & the central nervous system and the bone marrow which produces blood cells ,this reduces the no. of red blood cells. The person becomes sick , has sore throat ,nausea ,vertigo & diarrhea.

2- Exposure to a small doses of radiation for a longtime (months or years) causes:



a- Physical defects.
b- Genetic change in the sex chromosome results in abnormal births.
c- Changes in the structure of the cell such as the change in the structure of hemoglobin found in red blood cells. This changes makes red blood cell incapable of carrying oxygen.

Protection from radiation :

1-Avoid exposure to radiation .

2- Persons who handle radioactive elements in nuclear reactors & hospitals should wear protective gear (gloves, suits & masks).

3- When storing radioactive wastes, take the following precautions:

- Radioactive wastes should be stored away from underground water resources to prevent their pollution.
- Radioactive wastes are stored in a stable area away from volcanoes & earthquakes.
- Radioactive wastes are stored away from lands & caves to prevent the pollution from reaching animals.

The safe dose when exposed to nuclear radiation:

In general, we should not be exposed to nuclear radiation. The limit of the safe dose of radiation for those people who work in radiation field should not exceed 20 milli-Sievert per year. However, the safe dose of radiation for public should not exceed 1milli-Sievert per year.

The Sievert (Sv) is the international unit of measuring the radiation/ absorbed by the human body.

(1 milli-Sievert = 10^3 Sievert)



SCIENCE

Work sheets

Lesson three: Radioactivity and nuclear energy

Question one: Choose the correct answer:

1- Mass of the nucleus is concentrated in the ………………

(energy levels – nucleus – electrons)

2- The source which the atom gets its tremendous energy is known as ……….

(Nuclear energy – electric energy – heat energy)

3- There is …………… force between the components of the nucleus.

(repulsion – attraction – both are correct)

4- The French scientist ………….. is considered the discover of the radioactive phenomenon.

(Mendel – Ohm – Bequruel)

5- The radiation that comes out from the Uranium element is ……………. and has the ability to penetrate solids.

(visible – unseen – No correct answer)

6- ………………….. come (s) out from the radioactive element.

(rays only – particles only – both are correct)

7- The natural radioactivity is done by …………………

(Controlling the nuclear energy – No ability to control the nuclear energy – both are correct)

8- There are several theories for ……………… in the fields of atomic bomb.

(Dr.Ali Mostafa Mosharafa – Ohm – Mendel)

9- The natural sources of the radioactive pollution is represented by …………

(Cosmic radiation – nuclear reactors – no correct answer)

10- Chernobyl accident produces the isotopes of ………….. radioactive element.

(Uranium – cesium – polonium)

11- Bone marrow can be destroyed as a result of exposure to ………… amount of radiation for …………. periods.

(large and short – long and small – both are correct)

12- Physical effects take place as a result of the exposure to ………… amount of radiation.

(Large – small – both are correct)

13- The exposure to the small amount of radiation resulted in a cellular effects as ……………

(Spleen damaging – changing in the sex chromosomes – changing in the hemoglobin structure)

15- The area chosen for the storing of the radioactive wastes should be ………

(Unstable – away from the volcanoes – both are correct)

16- The medium radioactive wastes are disposed in the earth after ………….

(Surrounding them with a layer of the cement only – surrounding them with rocks only – both are correct)

17- ……………. is from the radioactive elements.

(Iodine – zirconium – sodium)

tion two: complete the following:

1 The nuclear energy arises from

……………………
……………………
……………………
……………………

……………………
……………………
……………………
……………………

……………………
……………………
……………………
……………………

2

1) The scientist who discovered the radioactivity is …………. ……………………

2) Types of the radioactivity are → ……………………, ……………………

3) From the type of the radioactive pollutions are

4) Radioactivity is ……………………………………

……………………………………………………………

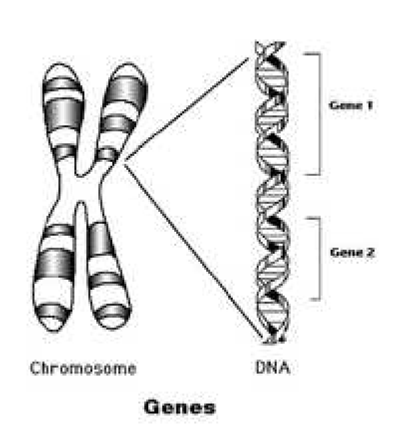
……………………………………………………………

…………………… Resulted from ……………………

…………………… Resulted from ……………………

Unit 3

Genetics



The Main Principles of Heredity

1. Hereditary traits :

They are the traits that are transmitted from one generation to another.

Examples

Hair colour, skin colour, number of fingers and the blood groups.

2. Acquired traits:

They are the traits that aren't transmitted from one generation to another.

Examples

The skill of playing football or writing.

How are hereditary traits transmitted from one generation to another?

Hereditary traits are transferred from one generation to another through the reproduction process and are governed by basics and laws.
The science which studies these laws is called "Genetics".

Genetic

It is a science that researches the transmission of the hereditary traits from one generation to another by studying the similarities and differences between the parents and the offspring.

Remembers

*** In asexual reproduction, the similarity is exact because offspring are produced from one parental cell.**

*** In sexual reproduction, there are similarities and differences between offspring as it is resulted from coupling of two individuals.**

Mendel's experiments

- The scientist Gregor Mendel was the first founder of heredity. - Gregor Mendel was a monk, born in 1822 in Brunn, Austria.

- He performed his experiments using pea plant in the garden of the monastery at Brunn.

- Mendel carried out a group of experiments that explained :

• How hereditary traits are transmitted from one generation to another.

• Why some traits of parents appear in their offspring.

The scientist Mendel

- Mendel performed his experiments using pea plant due to the following reasons :

The choice of pea plant

1. It is easy to be planted and it grows fast.

2. Its life cycle is short.

3. Its flowers are hermaphrodite, so it can be self-pollinated.

4. It can be easily artificially pollinated (human intervention).

5. It produces large number of plants in a generation.

6. It has several pairs of easily recognized contrasting traits.

- Despite the numerous different traits of pea plant, Mendel chose seven main traits to conduct his experiments.

• Seed shape (Smooth or Wrinkled).

• Seed colour (Yellow or Green).

• Pod (fruit) colour (Green or Yellow).

• Pod (fruit) shape (Swollen or Sinuous).

• Flower colour (Red or White).

• Flower position (Side or End).

• Stem height (Tall or Short).

First : The inheritance of one pair of contrasting traits

- Mendel studied the inheritance of each pair of these contrasting traits separated by the following specific scientific steps.

Mendel's experiment :

To study the inheritance of the seed colour trait of pea plant :

• **Steps :**

1. Mendel chose a pea plant that produces yellow seeds and other pea plant that produces green seeds for several generations, and he made yellow self pollination for these plants for several generations **to be sure of the purity of this trait.**

2. He planted the seeds of these plants. When flowers appeared on the produced plants, he removed the stamens from these flowers before the anther becomes mature **to insure that the plant doesn't self pollinate.**

3. Mendel made cross-pollination for :

- The flowers of yellow seed plants with pollen grains from green seed plants.

- The flowers of green seed plants with pollen grains from yellow seed plants.

4. He covered the stigmas of the pistils **to prevent cross pollination from other flowers** then he planted the produced seeds.

- Obs. : He observed that all the produced plants (first generation) have yellow seeds and the green coloured seeds trait disappeared completely.

5. Mendel let the first generation plants do self-pollination . Then he planted the resulting seeds.

- Obs.: The produced plants (the second generation) :

- Its quarter is of green seeds.

- Three quarters are of yellow seeds.

The inheritance of the seed colour in the pea plant

We can summarize the previous experiment in the opposite figure :

The principle of complete dominance

- Mendel repeated the same experiment on the seven traits of the pea plant and got the same results, where :

- He observed that:

* One of the two traits appeared in all offspring of the first generation and he named it **"the dominant trait"**.

* The other trait disappeared completely in the first generation and he named it **"the recessive trait"**.

Dominant trait

It is the trait that appears in all individuals of the first generation.

Recessive trait

It is the trait that disappears completelyin the individuals of the first generation.

*** This table indicates the seven pairs (dominant and recessive) of pea plant.**

Trait	Dominant	Recessive
• Seed shape :	Smooth	Wrinkled
• Seed colour :	Yellow	Green
• Pod (fruit) colour :	Green	Yellow
• Pod (fruit) shape :	Swollen	Sinuous
• Flower colour :	Red	White
• Flower position :	Side	End
• Stem height :	Tall	Short

The principle of complete dominance

It is the appearance of a dominant hereditary trait in the individuals of the first generation when two individuals are crossed, one of them carries a pure trait contrasting the trait carried by the other individual.

☆Mendel made several assumptions to explain the results he obtained in the experiments of the pea plant, these assumptions are:

1. In a living organism, every hereditary trait is controlled by two hereditary factors or (two genes) one from the father and the other from the mother.

NB

• These factors are similar or **homozygous** if the trait is pure and they are different or **heterozygous** if the trait is impure.

• The living organism that carries an impure trait is called **Hybrid**.

2. The hereditary traits are transmitted from the parents to the offspring by these factors (genes) through gametes.

3. Each gamete carries only one factor (one gene) for each hereditary trait because during gamete formation by meiosis the two hereditary factors (genes) for each trait is separated from each other.

*** Thus Mendel deduced what happens in his experiment as follows:**

1. • When the gametes carrying the **yellow** colour factor meet the gametes carrying the **green** colour factor, the **yellow** colour factor dominates.

• This leads to the production of only yellow seed in the first generation **Pure Yellow** + **Pure Green** ⟶ **Hybrid Yellow**

2. When the gametes of first generation are produced by meiosis the hereditary factors are ī separated from each other

3. These factors meet again in the production of second generation **Hybrid Yellow** + **Hybrid Yellow** ⟶ **Yellow** + **Greenroes**

3 : 1

4. If the **yellow** colour factor (homozygous) meets the green colour factors the result is a **yellow seed** [carries an impure trait hybrid plant]

If the **yellow** colour factor (homozygous) meets another **yellow** colour factor (homozygous) the result is a **yellow seed** [carries a pure trait]

If the **green** colour factor meets another green colour factor (homozygous) **the result is a green seed** [carries a pure trait] **Hybrid individual**

He is the individual who carries a different (contrasting) pair of genes one is dominant and the other is recessive.

Pure individual :

He is the individual who carries a similar pair of genes either dominant or recessive.

* **All these assumptions are the base of Mendel's first law, and he named it law of segregation of factors.**

Law of segregation of factors (Mendel's first law)

When two individuals of any pair of hereditary traits are different from each other, only the dominant trait appears in the first generation, while the two traits appear in the second generation in a ratio of 3 dominant trait : 1 recessive trait.



1. The dominant gene prevents the appearance of the effect of the other gene.
2. The recessive trait is always pure.

Application :

A pollen grain carries a gene of	An ovum carries a gene of	The produced seeds
1. Yellow seeds (pure).	Green seeds.	Hybrid yellow.
2. Yellow seeds (pure).	Yellow seeds.	Pure yellow.
3.Green seeds.	Green seeds.	Pure green.

Using symbols to represent the results of the experiment

The dominant trait is represented by a capital letter, while the recessive trait is represented by **a small letter**.

Example :

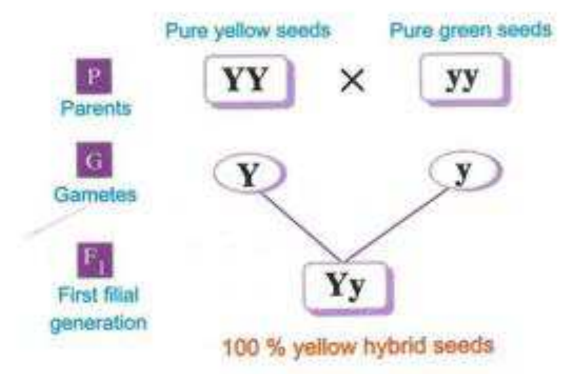
- The factor of the yellow seed colour (dominant trait) of pea plant is symbolized by (Y)
- The factor of the green seed colour (recessive trait) of pea plant is symbolized by (y)

SO,

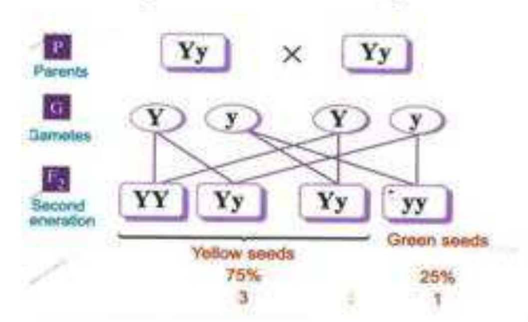
- The genetic structure of pure dominant individual is (YY).
- The genetic structure of hybrid dominant individual is (Yy).
- The genetic structure of pure recessive individual is (yy).

- The following diagram shows how the hereditary factors are inherited.

1. When a pea plant that has yellow seed colour (YY) is crossed with a pea plant that has green seed colour (yy)



2. When the plants of the first generation are left to self-pollinate.



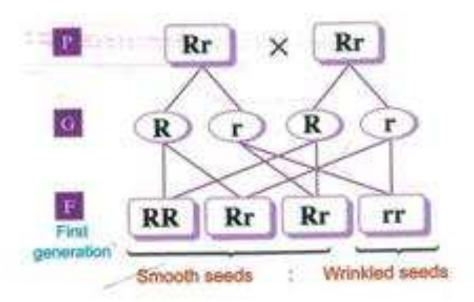
1. To discover the results of pollinating two pea plants that are different in flowers colour:

Example 1

Explain on the bases of genetic principles, crossing between two pea plants of hybrid smooth seeds. (knowing that smooth seeds trait (R) is the dominant and wrinkled seeds trait (r) is recessive).

Solution

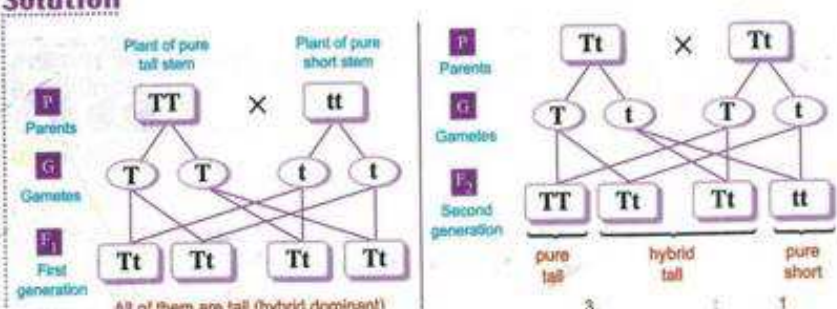
- The hybrid smooth seeds are represented by (Rr).
- The plants' seeds of the produced generation, some of them are smooth and the other are wrinkled at a ratio of 3:1



Example 2

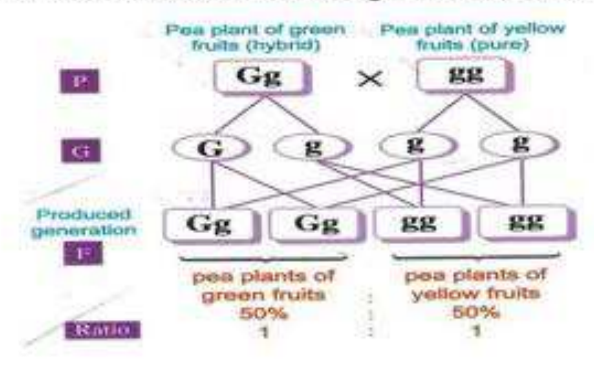
A pea plant of pure tall stem pollinates another one with dwarf (short) stem. Explain on the bases of genetic principles, the genetic structure of the first and second generations.

Solution



Example 3

If crossing takes place between two pea plants, one of them is of hybrid green fruits (Gg) and the other is of yellow fruits (gg). Explain on the bases of genetic principles the results of such crossing. Mention the ratio of the produced offspring



Solution

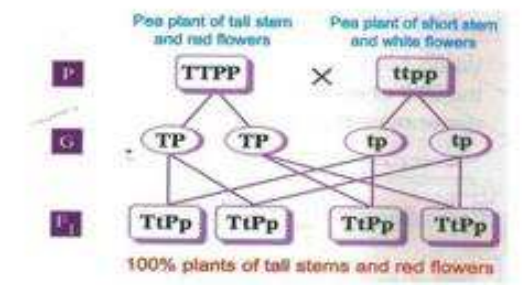
The percentage of the produced generation is 50% hybrid dominant : 50% pure recessive (i.e. 1:1).

Second : The inheritance of two pairs of contrasting traits

By another series of experiments, Mendel explained how two pairs of contrasting traits (as the red flower and tall stem) are inherited.

1. He conducted a mixed pollination between two pea plants :

- One of tall stem and red flowers (the two traits are pure dominant).
- The second with short stem and white flowers (the two traits are pure recessive).



2. Mendel observed that :

- All the first generation plants had tall stems and red flowers (two dominant traits).

3. When he left the first generation plants to self-pollination to produce the second generation individuals, he got the following ratios :

♂ ♀	TP	Tp	tP	tp
TP	TTPP	TTPp	TtPP	TtPp
Tp	TTPp	TTpp	TtPp	Ttpp
tP	TtPP	TtPp	ttPP	ttPp
tp	TtPp	Ttpp	ttPp	ttpp

9	3	3	1
Tall stem and red flowers	Tall stem and red flowers	Short stem and red flowers	Short stem and red flowers



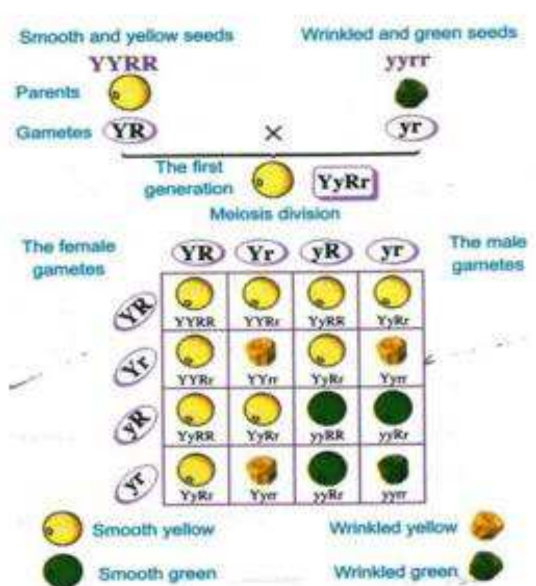
In the second generation, the ratio of the number of red flower plants (dominant) to white flowers (recessive) was 12 : 4 thus 3:1, and the ratio of the number of tall stem plants (dominant) to short stem (recessive) was 12 : 4 thus 3:1.

Law of independent assortment of hereditary factors (Mendel's second law)

When two individuals bearing a pair or more of alternative (contrasting) traits are crossed, the trait of each pair is inherited independently of the others and appears in the second generation at a ratio of 3 dominant trait : 1 recessive trait.

To discover the inheritance of two pairs of the contrasting traits:

The following figure shows the results of mixed pollination between a pea plant of two dominant pure traits (smooth and yellow seeds) and another one with two recessive traits (wrinkled and green seeds). Observe the figure and answer the questions which follow it.



1. What are the traits that appeared in the individuals of first generation ?
2. Are they dominant or recessive traits?
3. How many types of gametes produced by individuals of the first generation ?
4. Describe the second generation plants.
5. What is the ratio of the yellow seeds to the green ones in the second generation ?
6. What is the ratio of the smooth seeds to the wrinkled ones in the second Smooth yellow generation ?

Answer:

1. Smooth, yellow seeds. 2. Dominant. 3. Four types.

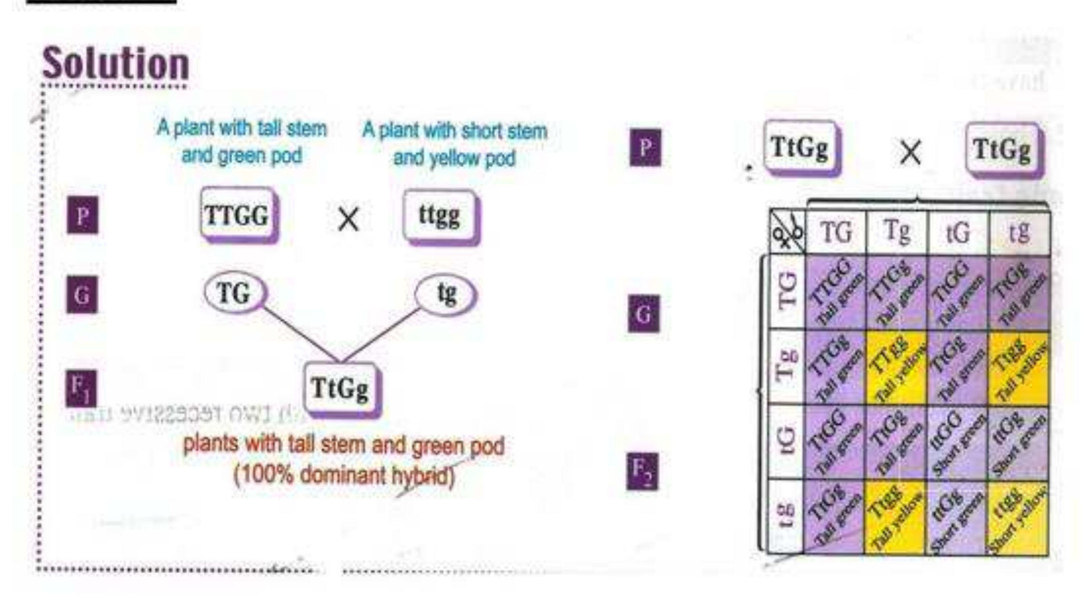
Smooth yellow	Smooth green	Wrinkled yellow	Wrinkled green
9	3	3	1

5. 12 : 4 thus 3:1 6. 12 : 4 thus 3:1

Example :

A pea plant with tall stem and green pod (TTGG) pollinates another one with short stem and yellow pod (ttgg). Explain on the bases of genetic principles, the genetic structure for the first and second generations.

Solution :



- We conclude from the individuals of the second generation that:

Tall stem and green pods	Tall stem and yellow pods	Short stem and green pods	Short stem and yellow pods
9	3	3	1

- From the previous results, Mendel's second law is verified, where :

- All the first generation plants had tall stem and green pods (i.e. only the two dominant traits appeared).

- In the second generation, the ratio between :

• The tall trait and short trait is :12: 4 (i.e. 3:1)

• The green pods trait and yellow pods trait is : 12:4 (i.e. 3:1)

The dominant and recessive traits in the human being

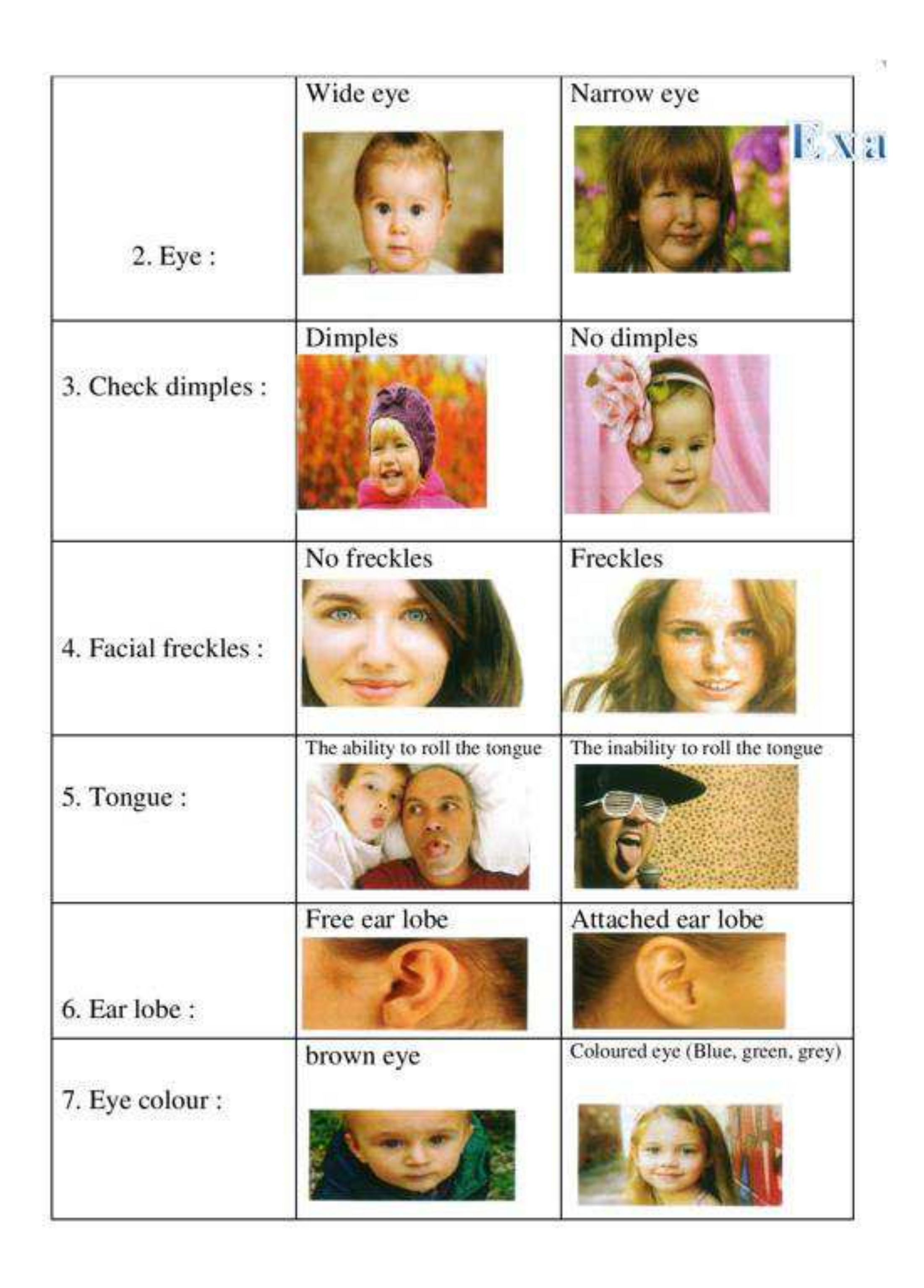
- Scientists found that many human hereditary traits follow the Mendelian heredity, where the trait is controlled by one pair of genes.

1. The individuals that inherit at least one dominant gene from one of their parents, will have the dominant trait.

2. Those who receive a recessive gene from both parents, will have the recessive trait.

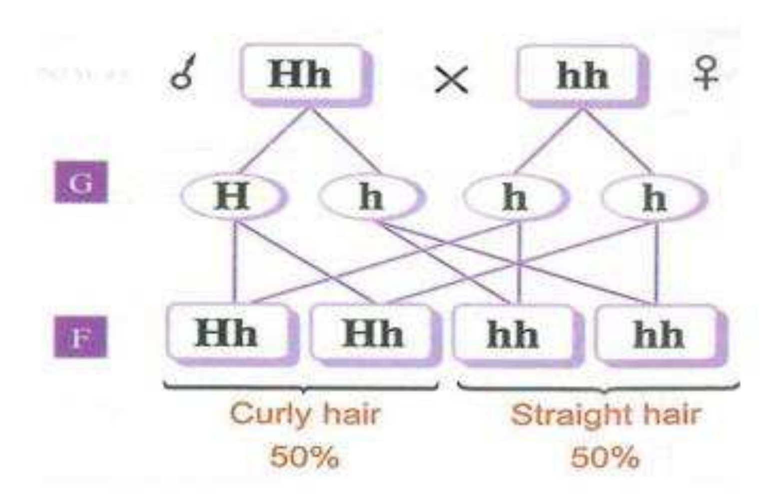
Some traits that follow the Mendelian heredity:

Trait	Dominant	Recessive
1. Hair :	Curly hair	Smooth hair
	Black hair	Light colour hair



2. Eye :	Wide eye	Narrow eye
3. Check dimples :	Dimples	No dimples
4. Facial freckles :	No freckles	Freckles
5. Tongue :	The ability to roll the tongue	The inability to roll the tongue
6. Ear lobe :	Free ear lobe	Attached ear lobe
7. Eye colour :	brown eye	Coloured eye (Blue, green, grey)

Explain on genetic bases, the traits of the offspring resulted from the crossing between a man who has curly hair (Hh) and a women who has straight hair and show the genetic structure.



Solution

The straight hair is a recessive triat, so the genetic structure of the women is (hh).

Genes

Hereditary traits are transmitted from the parents to their offspring through hereditary factors known as Genes.

What are the genes ?

- You have known from the first term that:

• The cell nucleus contains a number of chromosomes, and each chromosome consists of two chromatids.

• Each chromatid chemically consists of :

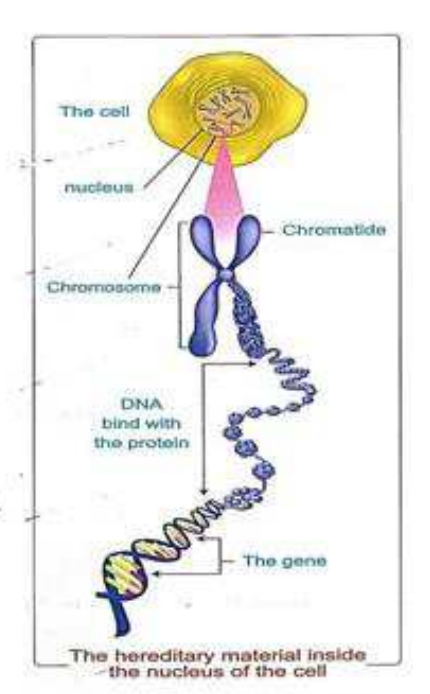
- DNA (a nucleic acid) which carries the hereditary traits of the living organism.

- Proteins.

So, Genes can be defined as :

Genes

They are parts of DNA present on the chromosomes and control the individual's hereditary traits.



The hereditary material inside the nucleus of the cell

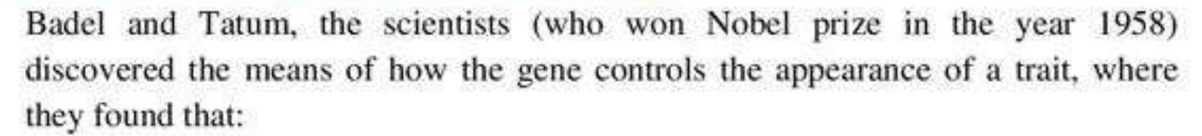
Scientists Watson and Creek were able to make a model of the DNA molecule :

- DNA molecule is composed of two strands coiled around each other like the spiral ladder called the double helix, where :

• The gene is the building block of nucleic acid (DNA).

• The gene consists of more smaller blocks (consecutive units) called nucleotides.

How do the genes perform their functions ?



Badel and Tatum, the scientists (who won Nobel prize in the year 1958) discovered the means of how the gene controls the appearance of a trait, where they found that:

- Every gene gives a special enzyme.
- This enzyme is responsible for the occurrence of a chemical reaction.
- Each chemical reaction resulting in a protein shows a specific hereditary trait.

* We can summarize the previous explanation in the following diagram:

So, the function of genes can be concluded as follows :

1. They control the body growth, features and functions.
2. They are responsible for the appearance of hereditary traits as hair colour, eye colour,……………… and so on.



How do you inherit your genes ?

The individual inherits half of his genes from the mother and the other half from the father as follows:

a. By meiosis division reproductive cells produce male gametes (N) and female gamet (N).

b. After fertilization, a zygote (2N) is formed and is divided mitotically many successive divisions to form the fetus.

c. Each cell in the fetus's body carries a complete set of genes responsible for the appearance of the hereditary traits.

Life application

- The human genome project

- This project started in October 1990

The human genome

It is a detailed map included all the human chromosomes.

The aims of the project:

1. The discovery of all the human inheriting factors (the genes).

2. Determination of the complete sequence of all the 3 billion pairs of nitrogenous bases to obtain a detailed map of this sequence which help scientists to understand the human biology and identify the single differences in the genome between one person and another.

3. Identification the genes responsible for the various diseases like cancer, diabetes, vascular diseases, mental diseases.

4. Identification the various hereditary functions to the human.

5. Identification the various mutations on the function of the genes.

- **The resultants of the project:**

• Scientists discovered that the DNA is similar in humans at a percentage of more than 99%.

• But the single difference at a percentage of less than 1% could affect to a great extent

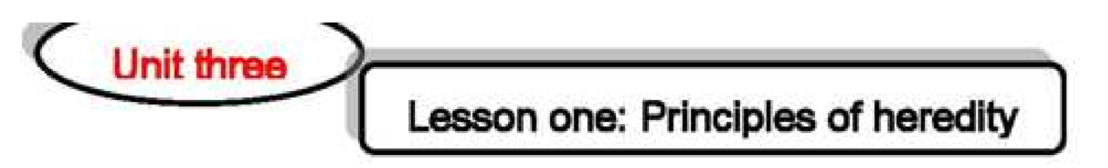
the acceptance of the individual to :

1. The harmful environmental effects like bacteria, viruses, poisons, chemicals.

2. Medicines and various treatments.

SCIENCE

Work sheets



Question one: justify:

1) There are two types of the traits.

....

....

2) Mendel has chosen pea plant to conduct his experiments.

....

....

3) Stamen has removed from the pea flowers during the experiment.

....

4) Mendel has covered the pistils of the pea flowers during the experiment.

....

5) Individuals may be hybrid or pure.

....

....

6) The two genetic factors are separated during the formation of the first generation's gametes.

....

7) When a pea plant with red flowers has pollinated with another one with white flowers, all the produced generation will be with a red flowers.

....

8) The absence of freckles considered as a dominant traits in the human.

....

Question two: complete the following:

1) There are two types of the traits in the livings ……………. and ………….
2) The scientist …………. has conducted the main principles of heredity.

3) The pea plant is ………….. , so it could be self pollinated .

4) The life cycle of the pea plant is ……………

5) Pea plant can be pollinated …………….. or ………………

6) In the pea plant there are contrasting traits as ……….. and ………flower's color ………….. and …………… pod's color , ………….. and ……….. seed's color.

7) The …………… trait appears in the first generation only, while the …………….. appears in the second with a percentage 25 %.

8) The …..… color of the pea plant's flower dominates the ………… flower color.

9) The genetic factors is ………… that transmitted from one generation to another through …………….

10) Gametes are formed in the 1st generation by …………. division.

11) Genetic traits are transmitted through …………..

12) The genetic factors of one trait are segregated during the formation of ………………

13) The symbols of the dominant trait is ………. , while the recessive one is …………….

14) The symbol (yy) represents the ………. trait.

15) The symbol (YY) represents the ………. trait.

16) The law of segregation states that ……………………………………………………………………………………

……………………………………………………………………………………

17) The dominant traits are inherited to the recessive one in the ratio ………. : ………

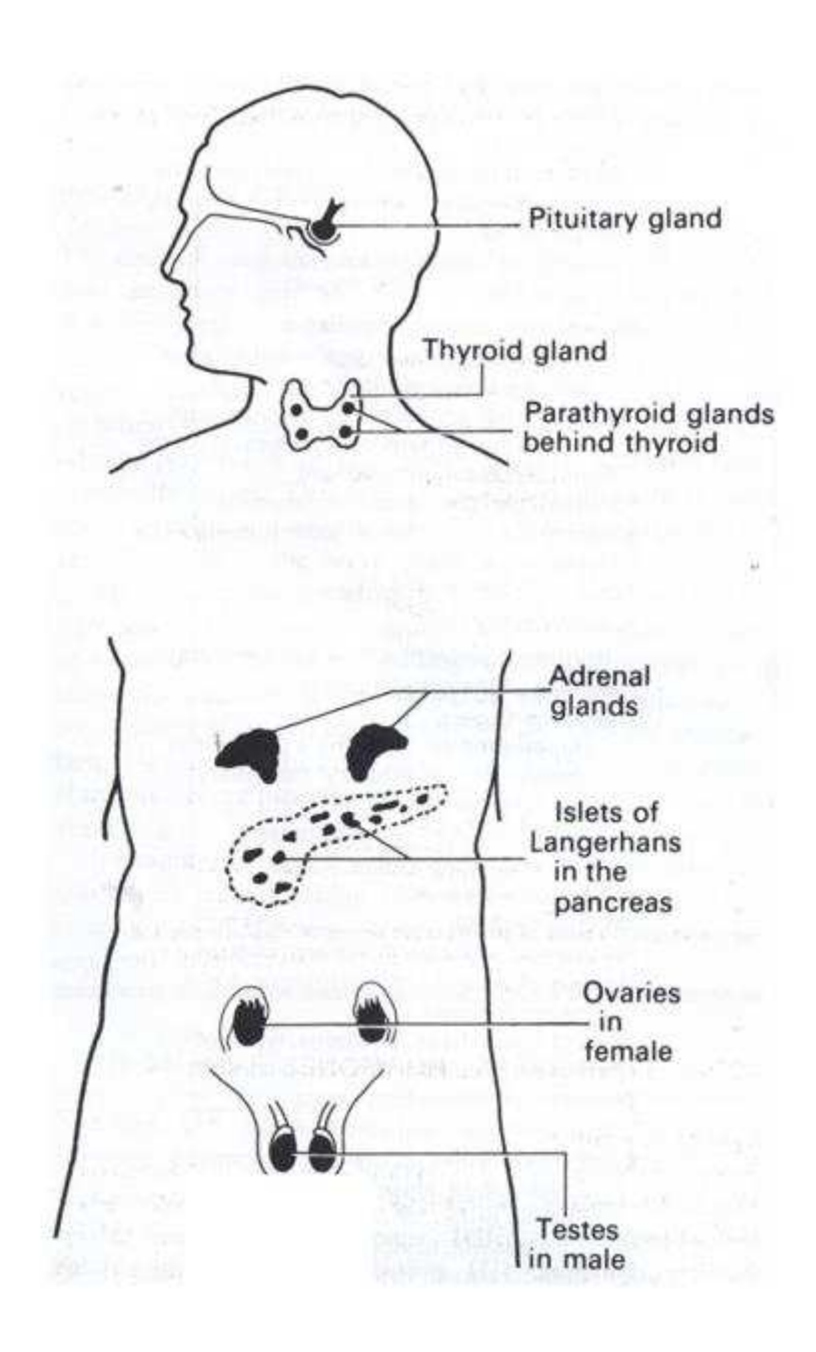
Unit 4: Hormones

Lesson 1: Hormones regulating the human body functions

- The internal environment of the body is regulated partly by the nervous system & partly by hormones.
- In the human body contains organs called **endocrine glands** which secrete chemicals called **hormones**.
- **Hormones** are means of regulating body function & maintaining homeostasis in the internal environment within the human body.
- When hormones secretion is disturbed , the body functions are also disturbed causing diseases such as **diabetes & goiter**.
- Endocrine glands are ductless glands which secrete hormones directly into the blood.
- The blood carries hormones to the targeted organ where they affect its function.

1. Hormones are chemical messages that regulate the biological functions in living organisms.
2. Endocrine glands secrete more than 50 hormones in the human body.
3. The targeted organs or tissues are the organs that respond to

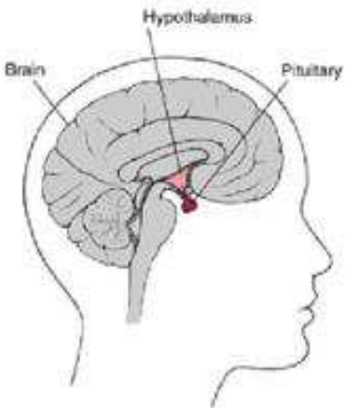



Pituitary gland
Thyroid gland
Parathyroid glands behind thyroid
Adrenal glands
Islets of Langerhans in the pancreas
Ovaries in female
Testes in male

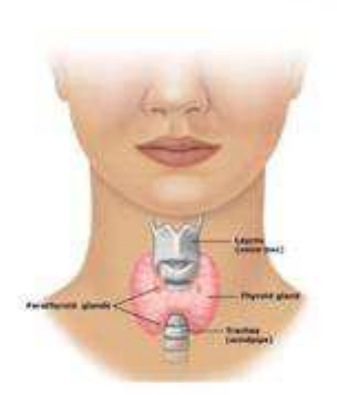
Some major endocrine glands in the human body

1. **Pituitary gland**

- This gland is situated below the brain . It has the size of a chickpea.
- It consists of two lobes & each secretes a group of different hormones.
- It's nicknamed the master gland because it secretes hormones which regulate many other glands.
- It secrets hormones which activate the thyroid gland & the adrenal gland.
- It also secretes hormones that activate & developes the testes (in males) and the ovaries in females at puberty.
- It secretes a hormone that targets the mammary glands & activates them to produce milk.
- It secretes another hormone that promotes uterine contraction before & during labour.
- It secretes a hormone that helps in regulating the amount of water in the body.
- It secretes **growth hormone** that targets your muscles & bones among other tissues & causes protein synthesis & growth of all tissues therefore it determines the height the person will reach in his adult stage.



Thyroid gland



- The thyroid gland is situated in the neck front.
- It consists of two lobes. One on either side of the trachea.
- It secretes a hormone called **thyroxine** that has a role in releasing energy from food inside cells.
- It also secretes another hormone called **calcitonin** which helps control blood level of calcium.

Pancreas

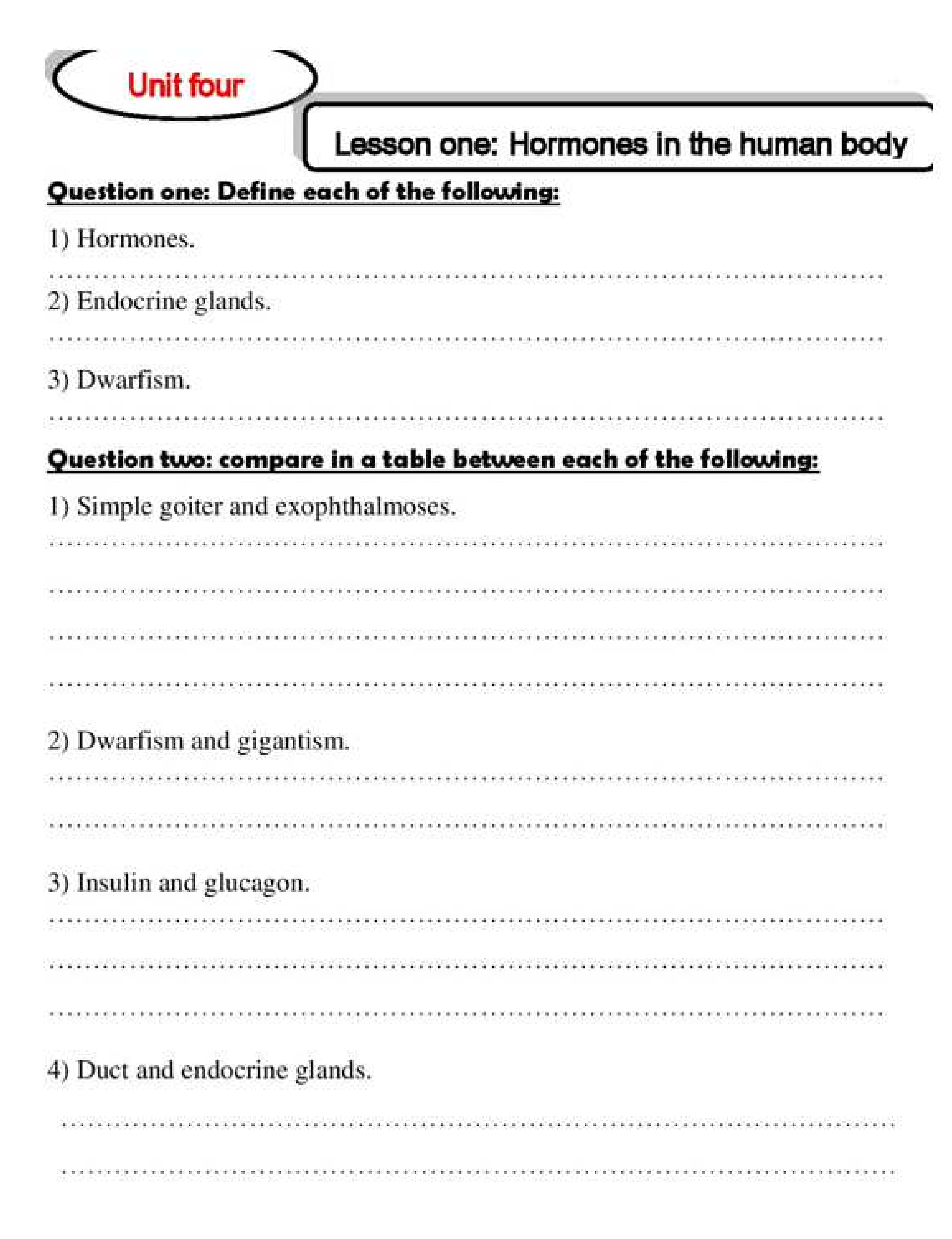
- The pancreas is situated in the abdominal cavity . It consists of a broad head , a body & a tail. The broad head is situated in the curve of the intestine. The body behind the stomach & the tail lies in front of the left kidney.
- The pancreas has a role in the process of food digestion.
- The pancreas also contains another type of cells considered as endocrine glands.
- They secrete the hormones **insulin** & **glucagon** which pass directly into the blood.
- Insulin helps sugar to go inside cells where it's burned to get energy therefore insulin reduces the level of sugar in the blood.
- Glucagon induces muscle & liver cells to release stored sugar & therefore raises blood sugar level . Sugar becomes available for the use of all body cells.
- Insulin & glucagon affect the level of glucose in the blood, each balancing the effect of the other.

The following table includes the glands , their secretions & their functions.

Gland	Hormone	Function
1.Pituitary	Growth Hormone	Growth of body tissue & their repair.
	Thyroid stimulating hormone	Activating the thyroid gland to release its hormones.
	Gonadotropic hormone	Activating the genital system at puberty.
2.Thyroid	Thyroxin	Releasing energy from food.
	Calcitonin	Regulating blood calcium level.
3.Parathyroid	Parathormone	Regulating bone calcium level.
4. Pancreas	Insulin	Stimulates the storage of glucose sugar in the liver.
	Glucagon	Stimulates the release of sugar from liver & muscle cells
5. Ovaries (in females)	Estrogen	Produces the secondary female sex characters
	Progesterone	The growth of the endometerium
6.Testes (in males)	Testosterone	Produces the secondary male sex characters

SCIENCE

Work sheets



Unit four

Lesson one: Hormones in the human body

Question one: Define each of the following:

1) Hormones.

2) Endocrine glands.

3) Dwarfism.

Question two: compare in a table between each of the following:

1) Simple goiter and exophthalmoses.

2) Dwarfism and gigantism.

3) Insulin and glucagon.

4) Duct and endocrine glands.

Question three: Give reason for:

1) Endocrine glands are called ductless.

....

....

2) Pituitary gland is called "the master gland".

....

....

3) Pituitary gland controls the height which the body will reach.

....

....

4) The importance of the thyroid gland.

....

....

5) Pancreas is a double function gland.

....

....

6) Hormones work as the thermostat in the electric appliances.

....

....

7) Human is infected with diabetes disease.

....

....

END